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The Anti-Holding-Company Bill

The administration anti-holding-company measure is entitled "A bill to prohibit unlawful restraint of trade or monopolies in interstate or foreign commerce by corporations through the device of intercorporate stockholding." The clear intent of the bill is to make unlawful the acquisition of stock of one company by another company where the effect is to eliminate or lessen competition between companies engaged in interstate or foreign commerce or to create a monopoly of any line of trade in any section or community. If the transmission of electricity from a point in one state to a point in another state is interstate commerce, the text of the bill would bring under the law many companies whose operations are conducted in part across state border lines. If it is a "line of trade" to supply electricity as a monopoly in any section and two or more companies are affiliated through stock ownership in such an enterprise, they would be doing a forbidden act. These illustrations serve to show that as the bill now stands it may affect many companies in the electrical industry. It is no comfort to officials of these companies to reflect that the bill is not intended primarily to disrupt their organizations but is directed at trade operations of a wholly different character. It ought to be possible for the lawmakers to find legally binding language to restrict the law to the abhorrent practices which they seek to correct. If they think that this is not possible, they at least can add a clause plainly exempting from onerous restrictions the class of public utility properties and holding companies whose practices are not criticised.

A Concrete Case for Co-operation

In the comprehensive campaign to secure the use of electric vehicles in parcel-post delivery service now being conducted by the Electric Vehicle Association of America, as described at length on a following page, there exists an unusual opportunity for the central stations of the country to do some definite, concrete co-operative work for the electric-vehicle cause—a cause which is of course identical with their own interests. Briefly, the vehicle association has undertaken to demonstrate to the authorities at Washington the advantages of specifying electric wagons for parcel delivery, and furthermore to encourage Congress to appropriate funds for the purchase of such electric-truck fleets. The extremely economical operation of electric delivery wagons in the service of department stores, express companies and the postal departments of other governments, no less than in the instances where they have been used in parcel-post service in this country, prove that the electric vehicle need stand only on its record of facts in order to sweep the field against all competitors. The work to be done at Washington, then, is simply that of bringing the truth about the electric vehicle adequately and persistently to official attention. This is already being done effectively by those who have the campaign in charge, but if the executives and commercial managers of the 6000 central stations of the United States will communicate to their Congressional representatives in both the Senate and the House their individual convictions concerning the desirability of electric parcel-post delivery, a powerful, country-wide influence—most potent because chiefly personal and direct—will be brought upon the national legislature to accomplish the result of parcel-post electrification.

A Problem in Steam Auxiliaries

The account in this issue of the Lewiston - Clarkston transmission system is most instructive in exhibiting the difficulties which hydroelectric systems sometimes encounter and the methods used to overcome them. In the system described irrigation is combined with the supply of energy for electric lighting and motor service. Water is too valuable an asset in that part or the country to be allowed to go to waste, and the task of the engineer is not to design an irrigation plant as such, or a pure hydroelectric system, but to utilize the water between the two to the best possible advantage. Two hydrolectric stations were built and put into successful operation, but the time eventually came when the demand for water for irrigation purposes became too great to allow the use of any further quantity for energy production, and hence it became necessary to install an auxiliary steam plant. When this plant was erected along the Snake River, from which it drew water for feed and condensation purposes, trouble began. This stream shows an enormous difference between the high and low water stages and carries at times a huge quantity of suspended matter, the result being a clogging of the condenser and loading of the feed and steam pipes with mud. During very low water the circulating pump could not raise the water high enough and had to be reinforced by an auxiliary pump. About three years ago, when the steam plant was found to be of insufficient size, an investigation showed the cheapest way out of the difficulty to be the installation of an entirely new separate steam plant alongside the old one, and the plant described and illustrated here is the result. Originally intended to be an oil-burning equipment, conditions arising after the

contract was let rendered the use of oil uneconomical, and a change was made to a coal-burning equipment. The new plant is built with a deep condenser pit, and the old difficulty with the condenser fouling has been overcome by an ingenious arrangement of piping which enables the flow through the surface condenser to be reversed to wash out the accumulated débris. The whole equipment shows what has to be done far oftener than one realizes in hydroelectric plants where water is scarce. It represents an ingenious adaptation of means to ends, rigorous economy in installation and the meeting of adverse conditions with prompt improvements.

Sixty-Cycle Synchronous Converters

The paper by Mr. L. P. Crecelius on the use of synchronous converters with a frequency of sixty cycles per second, read at the Cleveland Section meeting of the A. I. E. E. and abstracted in this issue, emphasizes the advantages to be obtained by adhering as far as possible to one and the same standard frequency. It used to be necessary to generate energy in large units at the lower frequency of twenty-five cycles per second in order to be able to use synchronous converters, because the difficulties in the design of these machines for the more generally used frequency of sixty were very great. In recent years, however, designers have been able to overcome many of the high-speed troubles in converters, so that sixty-cycle converters in large sizes are now recognized as standard machines.

We pointed out editorially last week that there exists a great advantage in retaining, as a uniform standard, the frequency of sixty. Not only is that frequency much more generally used than any other in this country, but it is also much better suited to arc and incandescent lighting than twenty-five, for purely physiological reasons. Finally, the size, cost and efficiency of alternating-current machines are usually improved by the use of the higher frequency. Frequency converters are not only expensive in first cost and maintenance, but they also consume a very appreciable amount of the energy they transform, besides adding to the mechanical inertia of the system in which they are installed. This added inertia reduces the flexibility of the system and its responsiveness to instantaneous demands.

The author draws attention to the practical importance of the power-factor on the heating of the sixty-cycle converters. If these must have their armatures boxed in to keep down the noise, the free ventilation of the machines is interfered with and the heat losses become more serious. A reduction of 2.5 per cent in the power-factor, from unity to 0.975, sounds very small, but the author points out that this means an increase of 57 per cent in the rate of heating the armature coils nearest to the taps. Incidentally, the author introduces a convenient means of defining and measuring the average monthly power-factor of a station. The "average monthly angle of lag" would have sounded rather austere in power-station contracts a few years ago, but no fault can be found with this measurement on the score of precision, unless the three-phase load should be much out of balance.

Power-Factor Adjustment

Mr. H. B. Dwight's article on power-factor adjustment offers some interesting suggestions for enlisting the aid of individual consumers in raising the power-factor of their alternating-current loads. There can be no dispute about the disadvantages of a low system power-factor, to which Mr. Dwight alludes. The installation by customers of induction machinery and apparatus at their own volition tends, as we all know, to lower the power-factor, choke the electric machinery and supply wires, impair the voltage regulation and make life less livable not only for the supply company but also for the other consumers on the same mains. The lowering of the power-factor by the heedless installation of lightly loaded induction motors is not merely an unfortunate mistake on the part of the customer guilty of the installation; it is, in a certain sense, a misdemeanor, in that it wastes energy unnecessarily and creates undue hardship for all others on the system. The customer may be, and often is, quite unconscious of wrong-doing. He is apt to suppose that any increase in his connected load is a pure beneficence to the electric-supply corporation. The idea that the installation of an induction motor on his premises may cause loss instead of gain to the central station ordinarily comes at first as a surprise, to say nothing of the bad effects on lamps and lighting in other houses on the same mains.

According to the author, the solution of the difficulty is to be found in persuading the customer to install synchronous motors, instead of induction motors, whenever possible, the inference being that, in order to improve his own voltage regulation, the customer will tend to take such precautions as will make the synchronous machines automatically improve the power-factor. Two general methods are suggested for influencing the choice of the customer in the installation of the proper kind of machinery. One is to insert an extra meter on his premises, so connected as to measure the reactive energy consumed, while the other meter measures the active energy in the usual way. He is then to be charged for the extra reactive energy at a rate, say, one-fourth of the regular rate for active energy. The other method is to offer a bonus for each kilovolt-ampere of synchronous motor machinery installed. It is probable that the equity of the case could best be met by the first method. That is to say, if a customer desires to install a machine that absorbs reactive energy to the disadvantage of the system and of all connected therewith, he should pay a proper price for the luxury, in proportion to the amount of reactive energy he consumes monthly. On the other hand, in view of the difficulty of explaining the nature of the trouble to the customer, the matter being essentially of a technical

character, and also in view of the difficulty of establishing an authorized rate for reactive energy, it seems likely that the second method, in some of its many possible forms, is likely to be more generally practicable.

Electric Arc Welding

The voltaic arc almost from the date of its discovery, near the beginning of the nineteenth century, was found to be capable of maintaining temperatures well above the melting points of the most refractory metals. In 1810 Sir Humphry Davy publicly demonstrated the melting of metals, including platinum and iridium, in the carbon arc produced with the aid of a large voltaic battery of 2000 cells. It was not, however, until many years later, and until the dynamo-electric machine had been commercially developed as a source of continuous current, that the idea seems to have been suggested of using the voltaic arc as a means of melting welding metals, particularly iron and steel. Dr. Siemens experimented with the arc welding of steel about 1880, and Dr. Bernardo developed a carbon-arc steel-welding process in 1887, using the steel to be welded as the negative electrode, a carbon rod as the positive electrode, and a stick of iron held in the arc as the source of molten metal to fill the weld. The amount of heat that can be produced in this way with an arc of several hundred amperes at more than 100 volts can be realized when one sees through dark glasses in a face mask a block of steel several centimeters thick melting and running like wax on the side of a paraffin candle in a drafty room.

In spite of the many attempts made at different times to introduce arc welding into industry after the Bernardo process was first exhibited, comparatively little use has been made of it. In an article on page 705 of this issue Mr. Otis Allen Kenyon points out that the recent development of the electric arc-welding process is attributable to the substitution of a coated metallic electrode for the carbon electrode. The carbon arc could not be satisfactorily applied in a number of practical cases, as, for example, to an overhead weld. One has only to think of the numerous physical and chemical conditions that are capable of influencing an arc weld in order to perceive how much skill, experience and technical knowledge are required to produce uniformly successful results. The metal on each side of the weld must be brought to the melting point so as to incorporate thoroughly with the new metal melted in, yet there must be no oxidation on the surfaces, no extensive heat stresses, no material chemical changes in the molten metal. There must be heat enough to melt, but not enough to allow the metal to run off, or to burn into pits.

The process of arc welding to the rings of the tunnel in the Rondout siphon is a very interesting and difficult application of the metallic arc, considering the very great hydraulic pressure to which the walls of this tunnel have to be subjected. The curves in Fig. 3 of the article indicate that the time required to weld a given length of plate increases very nearly as the square of the thickness of the plate. They also indicate that the angles of the opposed plate sections influence the welding speed materially, one-inch plate, with the most favorable abutment shown, welding as fast as half-inch plate with the least favorable abutment. An arc-welded seam is advantageous in that any defect is more likely to be detected by the eye without recourse to hydraulic test than if the seam is calked by hand. It remains to be seen whether the metallic arc will take the place of the calking tool in the construction and jointing of high-pressure boilerplates near each line of rivets.

Swiss Railway Electrification

The Swiss plans for railway electrification discussed before the New York Railroad Club by Mr. Emil Huber-Stockar furnish much food for thought. Mr. Huber-Stockar has been carefully studying electrification for several years past, and his long experience as manufacturer and engineer has given him a peculiarly effective training in everything that pertains to a problem of this sort. As our readers know from reports already published, the decision regarding the system of electrification, made after exhaustive study, was in favor of single-phase traction with commutator motors using, at least ultimately, 15,000 volts on the working conductor. This decision was not reached without much deliberation as to the advantages of its two possible rivals, direct-current at high voltage, and three-phase. The turning point in the discussion seems to have been the evident necessity for high voltage at the working conductor in order to supply the necessary energy for heavy trains from an overhead wire.

It is rather surprising to the ordinary engineer to find the choice of the single-phase system in this important case depending on its great working flexibility as well as on the simplicity of distribution. The commission seems to have threshed over the matter very thoroughly indeed, and from every possible point of view, so that its conclusions for this particular case must be received with a great deal of respect. It is perfectly clear, as Mr. Huber-Stockar made evident, that the Swiss problem was strictly a special one, and the solution reached is not necessarily applicable to conditions elsewhere. However, since several Continental countries have come to a similar conclusion regarding their own electrification problems and are putting these conclusions into practice, the Swiss situation seems not to be altogether peculiar. Good engineering consists in the successful adaptation of means to ends, and it is not safe to adopt a system for one use merely because it has proved thoroughly successful in another. Electrification of trunk lines is a task that demands most exhaustive consideration before decision is finally reached. It is enough for the present if the report of Mr. Huber-Stockar and his confreres makes it explicitly evident that single-phase traction cannot be left out of the reckoning when large railway work is undertaken.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

A. I. E. E. Nominations

The directors of the American Institute of Electrical Engineers have announced the selection of the following nominees for the next annual election: For president, Prof. Paul M. Lincoln, Pittsburgh, Pa. For vice-presidents, Messrs. F. S. Hunting, Fort Wayne, Ind.; Farley Osgood, Newark, N. J.; N. W. Storer, Pittsburgh, Pa. For managers, Messrs. Frederick Bedell, Ithaca, N. Y.; John H. Finney, Washington, D. C.; Bancroft Gherardi, New York; A. S. McAllister, New York. For treasurer, Mr. George A. Hamilton, Elizabeth, N. J.

Memorial to Westinghouse

It is understood that a movement is on foot among the national engineering societies to perpetuate the memory of the late George Westinghouse, and that the memorial will probably take the form of a statue which will be erected in some open space in Washington, D. C., the city in which Mr. Westinghouse spent some of the last years of his life. It is likely that the services of one of the most eminent American sculptors will be enlisted for executing the work. It will be a source of the keenest gratification to members of the engineering professions if some lasting and notable tribute be paid to the memory of the great inventor and administrator. A subscription of some $25,000 or $30,000 will probably be adequate for the carrying out of the plan.

Water-Power Research Advocated in Massachusetts

Hydraulic engineers and public officials appeared before the committee on ways and means of the Massachusetts Legislature last week to favor a resolution appropriating $25,000 for a continuation of the investigation of the water-power resources of the State and the development of a broad policy of utilization along the lines considered in a preliminary way by the special commission on water-power. This commission recently reported to the General Court urging that the work be continued. Chairman Forrest E. Barker of the Massachusetts Gas and Electric Light Commission, Mr. W. S. McNary of the Massachusetts Harbor and Land Commission, and Mr. Charles S. Davis of the Turners Falls Power Company were the principal speakers.

To Develop the Great Falls of the Potomac

The Commissioners of the District of Columbia have sent a report to Congress urging the adoption of the bill introduced by Senator Norris, of Nebraska, providing for the establishment of the Great Falls water-power plant on the Potomac River near Washington, D. C. The bill authorizes the Secretary of War to construct on the Potomac at Great Falls a power plant for the generation of electricity for municipal and government uses and in connection therewith to provide for increasing the water supply of the District of Columbia. The estimated cost of the project is $15,021,600, as determined by a survey made under a recent act appropriating $20,000 for an investigation of the possibilities of the site.

Radio Research Laboratory for Bureau of Standards

The Department of Commerce has asked Congress for an appropriation of $50,000 for the establishment of a wireless-telegraphy research laboratory in connection with the Bureau of Standards at Washington. It is planned to locate the laboratory in the recently completed electrical building of the Bureau of Standards, and the tower for the antenna will be erected on the east side of the structure. It is proposed to build the tower of masonry in order to preserve the unity of the architecture of the group of buildings.

Cut in Tungsten Lamp Prices

On April 1 the manufacturers of tungsten lamps in this country will place in effect new price schedules cutting the list price of tungsten lamps from 10 to 15 per cent. The 10, 15, 20, 25 and 40-watt lamps formerly listed at 35 cents will be listed at 30 cents; the 60-watt lamps formerly listed at 45 cents will be listed at 40 cents, and the 100, 150 and 250-watt lamps formerly quoted at 80 cents, $1.20 and $2 list respectively will hereafter be sold at 70 cents, $1.10 and $1.80 respectively, in standard package quantities, for circuits of from 100 volts to 130 volts. The frosted lamps are 10 per cent higher in price than the clear-globe lamps.

Contemplated Legislation Limiting Holding Companies

The text of the holding company bill was gone over by President Wilson on March 16 in a conference at the White House with Messrs. Clayton, Floyd and Carlin of the judiciary committee of the House of Representatives. As made public the bill as drawn up will make it unlawful for one corporation engaged in interstate commerce to acquire directly or indirectly the whole or any part of the stock or other share capital of another corporation engaged also in interstate or foreign commerce, where the effect of such acquisition is to eliminate or lessen competition between the corporation whose stock is so acquired and the corporation making the acquisition, or to create a monopoly of any line of trade in any area or community, or where the effect of such acquisition, or the use of such vote, by the voting or granting of proxies or otherwise, is to eliminate or lessen competition between such corporations, or any of them, whose stock or other share capital is so acquired, or to create a monopoly of any line of trade in any section or community.

The act does not apply to corporations purchasing such stock solely for investment and not using the same

by voting or otherwise to bring about, or in attempting to bring about, the lessening of competition.

It does not prevent a corporation engaged in interstate or foreign commerce from causing the formation of subsidiary corporations for the actual carrying on of their lawful business, or the natural and legitimate branches thereof, or from owning and holding all, or a part of, the stock of such subsidiary corporations when the effect of such formation is not to eliminate or lessen a pre-existing competition.

Illinois Ice Dealers Interested in Central-Station Energy

Following the short paper on electrical ice making read by Mr. C. J. Carlsen, of the Commonwealth Edison Company, before the sixth annual convention of the Illinois Ice Dealers' Association at the Hotel Sherman, Chicago, March 18, many questions were asked regarding the cost of central-station energy for ice manufacture. Mr. Carlsen explained the contracts existing between the Commonwealth Edison Company and the numerous ice manufacturers on its circuits, and stated that where electrical energy can be purchased for 1 cent per kw-hr. it competes favorably in production cost with a steam-driven ice factory.

Nitrogen-Filled Lamps for Hartford Street Lighting

Nitrogen-filled series tungsten lamps are to be installed by June 1 in the business district of Hartford, Conn., for ornamental street-lighting service under a five-year contract recently made by the city with the Hartford Electric Light Company. The lamps are to be placed on 141 double and 113 single standards and are to deliver 300 cp each at an angle of 20 deg. below the horizontal through acorn-shaped diffusing globes carried at a height of 15 ft. above the street surface. For each double-lamp standard the city will pay $80 per year and for each single-lamp standard $55 per year, the service to be from dusk until dawn. The city is to furnish the standards and the company is to care for their installation and maintenance and to provide and maintain all other equipment associated with the installation.

New Street-Lighting Contract at Boston

At its next regular meeting the Boston City Council will be asked to ratify a ten-year street-lighting contract between the city and the Edison Electric Illuminating Company, in which the price per lamp will be reduced from $103 to $87.53 per annum. Five thousand 6.6-amp magnetite-arc lamps are involved, and the saving to the city in ten years as a result of the company's willingness to grant the reduction will be $773,500. The proposed contract will be dated from April 1, the date on which the present five-year contract between the city and the company terminates. In a recent interview Mayor Curley expressed "much satisfaction over the magnanimous manner in which the officials of the company waived their advantage under the existing contract, under the provisions of which the company should have been notified by April 1, 1913, that a revision was to be taken up." On account of the absence of this notification, the company could have insisted upon the maintenance of the price of $103 per lamp for five years more, had it so desired.

Electric-Vehicle Co-operation in Chicago

At the luncheon of the Chicago Section of the Electric Vehicle Association on March 17 it was voted to indorse the "safety first" movement of the Chicago Motor Club. Preparations for the annual meeting in May were discussed, and some novel features are promised. The interesting announcement was made that the Chicago Garage Owners' Association has offered to give a "boost" of electricity without cost at any member's garage to any member of the Chicago Section of the Electric Vehicle Association who will identify himself as such. At the meeting of the section on March 31 Mr. Everett P. Stroup will give a talk on "Pneumatic Tires for Electric Vehicles."

Conductivity of Creosoted Cross-Ties

At the quarterly meeting of the Railway Signal Association held at Chicago March 16 much time was devoted to the approval of various standards and forms of specifications being prepared by standing committees. The report on signaling practice included interesting tests on the use of creosote for treating cross-ties, as well as electrical tests of cross-ties so treated. The results obtained from the latter experiments indicated that dry creosoted ties themselves are of low conductivity, nor is their conductivity increased to any great extent by the addition of a slight percentage of moisture. The addition, however, of a salt solution, such as the drippings from refrigerator cars, brings about so great a reduction in resistance as to interfere seriously with successful track-circuit maintenance.

$6,000,000 Expended on Ontario Hydroelectric System

According to the annual report of the Hydro-Electric Power Commission of Ontario, which was tabled in the Legislature of the Province on March 16, the system with all its branches represents a capital expenditure up to the end of 1913 of $5,915,000. Of this amount $5,190,000 has been spent for building the transformer stations and transmission lines of the Niagara district. The Port Arthur system represents an expenditure on capital account of $90,425; the St. Lawrence system, $93,666; the Severn, $234,946; the Renfrew, $17,761, and the Penetang, $15,153.

The money to build these various systems has been advanced by the provincial treasury, and the profits of the municipal systems are paying into the Province interest at the rate of 4 per cent on all advances. The expenditure of the Province, which represents the contribution for cheap electricity for the people as a whole, was at the year end $138,592. This covers engineering assistance to municipalities, investigations, reports, etc., and equipment for rural and farm demonstrations. The expenditure during the year was $1,333,408. The extent to which the Hydro-Electric system is serving the people of the Province is illustrated by a table showing that, while in 1912 there were 33,568 consumers of energy for lamps and 1399 users of energy for motor service, these figures increased at the end of 1913 to 63,157 and 2532 respectively, or a total of 65,689.

There are now forty-five municipalities in the various systems, with a total annual expenditure of $1,999,043, of which $1,511,048 represents operating and maintenance charges. In 1912 the total revenue was $1,617,674, and in 1913 the revenue was $2,611,918.

The surplus for the year is given as $620,875, as against $240,506 in 1912. Allowing $230,480 as a depreciation charge, the net profit for the year is stated to be $390,395. The total plant value of the municipalities is $9,196,483 and the net debenture debt and overdraft is $8,353,819. The gross surplus invested in plant extension now amounts to $861,381. There is a depreciation reserve of $410,327 and a net surplus from operation so far of $451,054.

Michigan Section, N. E. L. A., Plans Sightseeing Convention Trip

The Michigan Section of the National Electric Light Association has arranged elaborate plans for its annual convention June 17 to 20 inclusive. These four days will be occupied with water trips on Lakes Erie and Ontario and on the St. Lawrence River, and with electric and steam-railway rides in the vicinity of Niagara Falls. The delegates will gather at Detroit, Mich., leaving there at 5 p. m. on June 17 and traveling overnight by boat to Buffalo, whence the party will visit Niagara Falls. The trip on Lake Ontario and down the St. Lawrence will start at Youngstown, N. Y., passing through the Thousand Islands, with a stop at Ogdensburg, N. Y., and finally returning to Toronto, Ontario, from which point a daylight run will be made to Detroit by train. The convention sessions will be held during the several stages of the trip, the expenses of which will aggregate $30 per person. Mr. Herbert Silvester, 18 Washington Boulevard, Detroit, is secretary and treasurer of the Michigan Section, N. E. L. A.

Rate Investigations in the Twin Cities

Since last May an investigation has been under way in the city of St. Paul, Minn., to determine whether there should be any change in the rates charged by the St. Paul Gas Light Company and the Consumers' Power Company for gas, electricity and district steam heating. Mr. E. W. Bemis, of Chicago, the public utility expert, was retained by the city to make the investigation. Under his direction Mr. Charles L. Pillsbury, of Minneapolis, consulting engineer, has made an engineering appraisal of the property of both companies and Marwick, Mitchell, Peat & Company have made a study of the accounts of both companies. These reports have been turned over to Mr. Bemis and are now being examined by him. Mr. Bemis' report will be ready for presentation, probably next month.

In Minneapolis the city is engaged in an investigation of the rates of the Minneapolis Gas Light Company. Since Jan. 1 the consumers have been paying but 70 cents per 1000 cu. ft., the former rate having been 85 cents. The case is, however, in the courts. Mr. William D. Marks the city's public utility expert, died during the pendency of the case, and Mr. Bemis has been retained in this case also on the part of the city.

Southeastern Section of the N. E. L. A.

The next annual meeting of the Southeastern Section of the National Electric Light Association will be held at the Isle of Palms, Charleston, S. C., from Aug. 19 to 21. This meeting place is at one of the finest Southern beaches, about 12 miles from Charleston. Special rates to the convention have been arranged for. The association has made considerable progress during the last year under the able leadership of President Thomas W. Peters, of the Columbus (Ga.) Railroad Company. The secretary and treasurer, Mr. A. A. Wilbur, of Columbus, Ga., has also been very active in the affairs of the society. Mr. C. D. Flanigen, vice-president and general manager of the Athens Railway & Electric Company, is chairman of the committee on exhibits; Mr. C. M. Benedict, assistant secretary and treasurer of the Charleston Consolidated Railway & Light Company, is chairman of the entertainment committee; Mr. W. W. Fuller is chairman of the advertising committee.

Hearing at Boston on Regulation of Hydroelectric Companies

The committee on public lighting of the Massachusetts Legislature held a hearing on March 11 on the Horgan bill for the placing of hydroelectric companies under the supervision of the Board of Gas and Electric Light Commissioners. The bill extends the powers of the board along the lines at present applying to the jurisdiction of gas and electric lighting companies, with supervision of rates, service, security issues, returns of operating revenue, expenses, etc.

President Henry I. Harriman of the Connecticut River Transmission Company, Boston, stated that those in control of New England's largest hydroelectric system are not opposed to reasonable and proper regulation, the time being ripe for such a policy on the part of the State. He preferred, however, to have the subject taken up in connection with the proposed codification of laws relative to the manufacture, distribution and sale of gas and electricity. Mr. William H. Brooks, counsel for the Ludlow Manufacturing Associates and Holyoke Water Power Company, and Mr. W. Rodman Peabody, counsel for the Amherst Power Company, favored taking up the proposed regulatory powers under the forthcoming codification. Chairman Barker, of the Gas and Electric Light Commission, favored action upon the case as an independent matter.

New York Court on Going Value

The New York Court of Appeals rendered a decision on March 24 holding that the Kings County Lighting Company is entitled to an allowance for going value in a valuation for rate-making purposes. The decision reverses the order of the New York Public Service Commission, First District, which directed the company to reduce the price of gas from 85 cents to 80 cents per 1000 cu. ft. The decision also holds that the company is not entitled to include in its tangible assets amounts paid for street improvements and appreciation in the value of land owned. The case was returned to the commission for redetermination.

The decision of the court, which was unanimous, was written by Judge Miller and said in part:

"I define 'going value' for rate purposes, as involved in this case, to be the amount equal to the deficiency of net earnings below a fair return on the actual investment due solely to the time and expenditures reasonably necessary and proper to the development of the business and property to its present stage and not comprised in the valuation of the physical property. Going value is to be appraised by showing the actual expenditures of the company, the original investment, its earnings from the start, the time actually required and the expenses incurred in building up the business, all expenditures not reflected by the present condition of physical property, the extent to which bad management

or other causes prevent or deplete earnings, and any other facts bearing on the question, keeping in mind that the ultimate fact to be determined is not the amount of the expenditures but the deficiency in the fair return to investors due to causes under consideration.

"The difficulty of determining the 'going value' will not justify the disregard of it. Rate making is difficult. But that will not justify confiscation. It may be conceded that going value has no existence apart from tangible property and that commercially there is but one value, that of the property as a whole, but as the rate cannot be made to depend upon the exchange value, which would in turn depend upon the rate, it would seem to be necessary to appraise the physical property and the going value separately."

Cost of Living and State Water-Power

One of the bulletins issued by the Empire State Gas & Electric Association in reference to the Velte-Smith hydroelectric bills now pending in the New York State Legislature discusses the cost of living in connection with the suggested plan of the State to develop water-power. It says in part:

"The avowed purpose of the advocates of the Velte-Smith hydroelectric bills, now before the Legislature, is to reduce the cost of living through lower rates for lighting.

"The cost of lighting at the present time averages only from 1 to 2 per cent of the cost of living and is one of the smallest items on the list of regular expenses. If it is really advisable for the State to go into business in order to reduce the cost of living, there are other lines in which even a small saving, if accomplished, would amount to more than the entire cost of lighting. For instance, food amounts to 35 to 45 per cent of the cost of living, and a 5 per cent reduction in this item would be the same as the furnishing of light for nothing. Besides this, the price of food is steadily going up while the price of light is steadily going down, and that without any great expense to the State.

"If the conservation commission and the other advocates of these bills are really sincere in their belief that the State can run a business economically and that it is the duty of the State to go to the extent of entering into competitive business in order to reduce the cost of living, why do they not start with some business where the saving might amount to something? Why do they not propose state butcher shops, state groceries, state bakeries and even state restaurants to be operated at cost for the benefit of the people?"

American Railway Engineering Association

Previous attendance records were broken at the fifteenth annual convention of the American Railway Engineering Association held at the Congress Hotel, Chicago, March 17 to 20. In his presidential address Mr. Edwin F. Wendt, member of the engineering board of the Interstate Commerce Commission, dwelt on the growth of the association and its financial affairs and committee work, and spoke at some length on recent advances in signal and track construction, development of electric traction and the valuation of common carriers. In closing the speaker stated that, in his opinion, the broad future of railroad electrification was dependent upon a thorough demonstration of its economic advantages over steam.

Of the committee reports submitted several were of electrical engineering interest. The report of the committee on electricity, of which Mr. C. W. Kittredge is chairman, was divided into two parts, one of which dealt with clearance diagrams, the other portion being confined to discussions of electrolysis. Five clearance diagrams presented by the committee were adopted, four of these having beeen considered jointly by the American Railway Engineering Association and the American Electric Railway Association. The fifth, a minimum clearance diagram, will be considered in the joint meeting of these committees. The report of the committee on electrolysis was received as indicating progress and the work of this committee will be continued.

President Wendt acted as toastmaster at the fifteenth annual banquet of the association given in the "gold room" of the Congress Hotel. In the course of the evening the election of the following officers for the coming year was announced: President, Mr. W. B. Storey, vice-president Atchison, Topeka & Santa Fe Railroad Company, Chicago; vice-president, Mr. Robert Trimble, chief engineer maintenance of way, northwest system of the Pennsylvania Lines West of Pittsburgh; second vice-president, A. F. Baldwin, chief engineer Illinois Central Railroad, Chicago.

Municipal Electric-Light Stations of the United States

The issue of March 14 contained statistics of all the electric-light stations in the United States based on information given out by the Bureau of the Census. Although the number of municipal plants was given in the compilation, information regarding their income, output, etc., was included with that of the private central stations of the country. The Bureau of the Census has just released detailed information on the purely municipal electric-light plants.

MUNICIPAL ELECTRIC LIGHT PLANTS OF THE UNITED STATES

	1912	1907	1902	Per Cent of Increase: 1902-1912
Number of stations	1,562	1,252	815	91.7
Income	$23,218,989	$14,011,999	$6,965,105	233.4
Electric service (light, heat and power, including fire service)	$22,663,708	$13,614,434	$6,836,856	231.5
All other sources	$555,281	$397,565	$128,249	333.0
Total expenses, including salaries and wages	$16,917,165	$10,316,620	$5,245,987	222.5
Total number of persons employed	7,940	5,566	3,417	132.4
Total horse-power	559,328	321,351	160,028	249.5
Steam and gas engines (including turbines):				
Number	2,307	1,792	1,078	114.0
Horse-power	429,067	289,500	147,975	190.0
Waterwheels:				
Number	269	153	82	328.0
Horse-power	130,261	30,347	11,218	1,061.2
Auxiliary engines:				
Number	*	72	36	.....
Horse-power	*	1,504	835	.....
Kw rating of dynamos	368,677	209,016	113,380	225.2
Output of stations, kw-hr	537,526,730	289,462,788	195,904,439	174.4
Estimated number of lamps wired for service:				
Arc	91,851	†82,940	50,795	80.8
All other varieties	7,057,849	†4,061,318	$1,577,451	347.4
Stationary motors served:				
Number	21,895	4,507	1,962	1,016.0
Horse-power	164,291	31,689	3,324	4,842.6

*Not reported separately.
†Includes, for purposes of comparison, 595 arc and 28,579 incandescent lamps reported by the electric companies to light their own properties. Lamps used for such service were included in the total number reported in 1912.

As a rule, no cash income is derived by municipal stations for electrical energy used for lighting streets and public buildings. In order that the income shown may approximate the total consumption and sale of electrical energy by the stations, the census schedule required that the income for service of this character

should be estimated on the basis of what would have been charged for similar service by commercial companies in nearby localities. The number of persons employed may fall short of the total number actually engaged in work in connection with the operation of the electric stations, because employees for the electrical work often are not required for long or continued service, and they are reported with that branch of municipal work with which they are chiefly employed.

Minnesota Electrical Association at Minneapolis

The seventh annual convention of the Minnesota Electrical Association was held in Minneapolis, March 18, 19 and 20. Mr. P. T. Glidden, general manager of the Consumers' Power Company, St. Paul, presided, and the electrical men were welcomed to the city in a felicitous speech by Mayor G. Nye. After introductory remarks by Mr. Glidden and the reading of a report by Mr. Fred A. Otto, of the St. Paul Gas Light Company, secretary-treasurer of the association, the following papers were read: "Motor Applications," by Mr. C. W. Drake, of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; "The Public and Public Service Corporations," by Mr. R. F. Pack, general manager of the Minneapolis General Electric Company; "Co-operation," by Mr. M. J. Wolf, of the Chicago office of the Hotpoint Electric Heating Company (read by Mr. W. C. Beckford, of St. Paul); "Accounting," by Mr. F. C. Hoffman, of the St. Paul Gas Company, and "Safety First," by Mr. John P. Gardner, assistant commissioner of the Minnesota Department of Labor and Industries. Interesting addresses were made by Prof. W. T. Ryan, of the University of Minnesota, on extension work, and Mr. S. E. Doane, of Cleveland, chief engineer of the National Electric Lamp Association, on recent developments in electric lighting. Abstracts of these papers and addresses will be given in a later issue.

On recommendation of a nominating committee headed by Mr. B. W. Cowperthwait, of Faribault, officers were elected as follows: President, Mr. R. E. Brown, Mankato; vice-presidents, Messrs. B. W. Lynch, Minneapolis, and Alfred Horne, Fairmont; secretary-treasurer, Mr. Fred A. Otto, St. Paul Gas Light Company St. Paul; executive board Mr. Brown, Mr. Otto, Mr. P. T. Glidden, St. Paul; Mr. E. F. Strong, Chaska, and Mr. R. F. Pack, Minneapolis. Mr. Robert E. Brown, the new president, is manager of the Consumers' Power Company at Mankato, Minn. He was formerly first vice-president of the association.

Interstate Trade Commission Bill

The text of a new bill providing for the creation of an interstate trade commission has been made public. The bill was drafted by a sub-committee of the committee on interstate and foreign commerce of the House of Representatives. It provides for a commission of three members, to be appointed by the President by and with the advice and consent of the Senate. Upon the organization of the commission and the election of its chairman all the existing powers, authority and duties of the Bureau of Corporations and the Commissioner of Corporations shall be vested in the commission.

Every corporation engaged in commerce, excepting corporations subject to the act to regulate commerce, which, by itself or with one or more other corporations owned, operated, controlled or organized in conjunction with it so as to constitute substantially a business unit, has a capital of not less than $5,000,000, or having less capital belongs to a class of corporations which the commission may designate, shall furnish to the commission annually such information, statements and records of its organization, bondholders and stockholders and financial condition, and also such information, statements and records of its relation to other corporations and its business and practices while engaged in commerce, as the commission shall require.

Upon direction of the President, the Attorney-General or either house of Congress, the commission shall investigate and report the facts relating to any alleged violations of the anti-trust acts by any corporation.

In any suit in equity brought by or under the direction of the Attorney-General, as provided in the anti-trust acts, the court may refer to the commission any question relating to the relief to be granted or any proposed decree therein, whereupon the commission shall investigate the matters referred to it and make a full report to the court.

Whenever a final decree has been entered against any defendant corporation in any suit brought by the United States to prevent and restrain violation of the anti-trust acts, the commission shall have power and it shall be its duty upon its own initiative or upon application of the Attorney-General to make investigation of the manner in which the decree has been carried out. It shall transmit a report to the Attorney-General.

Nothing in the act shall be construed to prevent or interfere with the Attorney-General in enforcing the provisions of the anti-trust acts or the acts to regulate commerce.

Use of Sixty-Cycle Synchronous Converters at Cleveland

At Cleveland, Ohio, some 15,000 kw of sixty-cycle, six-phase, 600-volt synchronous converters have now been in railway service for more than a year. These machines are installed in four substations in the suburbs of the city, and their successful operation has established a precedent for the use of sixty-cycle alternating-current energy on such a large scale, according to Mr. L. P. Crecelius, superintendent of motive power for the Cleveland Railway Company, who on March 23 presented a paper on the subject before the Cleveland Section of the American Institute of Electrical Engineers.

The advantages of sixty-cycle railway apparatus, as pointed out by the author, include standardization of frequency, low cost and high efficiency. The converters are of the commutating-pole type and have a number of special features of design. The improvement of commutation due to commutating poles makes it possible to use fewer poles and higher armature speed, but the latter practice has the objection of increasing the noise to a degree which would have proved objectionable in neighborhoods where these machines were used. To overcome the noise the armature ends were sealed up and a shield was provided behind the front leads, thereby cutting down the ventilation to a considerable extent. The field windings were also compounded in order to hold the direct-current voltage constant. In order to maintain the power-factor of the supply circuit at unity the converters are operated over-excited, thus producing a leading wattless current sufficient to overcome the reactance drop. To overcome the heating effect due to restricted ventilation and over-excitation a density of 3500 amp per square inch of armature conductor, based upon direct current output of rating, was adopted. To permit of alternating-current starting

copper dampers are interconnected between the poles to produce a squirrel-cage connection all around the field structure. Appended to the original paper are given extracts from the specifications under which the machines were built, as well as extracts from the contract under which the energy supplied to the substations is purchased.

In conclusion, from his experience with the use of sixty-cycle, 600-volt synchronous converters for railway work the author points out that: (1) Pulsations in the alternating-current supply circuit must be entirely eliminated; (2) the design must include, in addition to the commutating-pole feature, liberal proportions of iron and copper, notwithstanding the high speed; (3) field dampers must be very low in resistance and bridged to permit of alternating-current starting.

Heavy Railway Electrification

At a meeting of the New York Railroad Club on March 20 Mr. Emil Huber-Stockar, permanent consulting engineer on electrification for the Swiss Federal Railways, delivered an illustrated address relating to the plans of the Swiss government for hauling trains over the St. Gothard tunnel route by means of electric locomotives. He remarked that Switzerland can be considered nearer to general electrification than is any other country, because the public is aware of the desirability of utilizing water-powers to compensate for the lack of native coal. The principal benefits to be obtained from electrification are the raising of speeds on grades, the increase of tonnage per train, the elimination of extra and pusher locomotives, and, last but not least, the elimination of smoke in tunnels to encourage travel and reduce track maintenance.

Mr. Huber gave the report made by the board of managers to the board of directors of the Swiss Federal Railways, in abstract, as published in the *Electrical World* for March 21. Referring to the question of system, Mr. Huber said that the Electrification Commission (see *Electrical World*, March 7, 1914) recommended the single-phase system, although the costs of the direct-current three-phase and single-phase systems are not greatly apart, for the reason that single-phase will give the greatest flexibility in speeds on the Swiss railways as a whole. However, no final decision has yet been made because further data can be gathered while the power plants are being constructed. If the single-phase system be adopted ultimately, it is quite possible that half-voltage—7500 volts—will be used during the transition period from electricity to steam in order to avoid troubles from the deposit of smoke on the insulators, etc.

Discussion

Mr. George Gibbs, consulting engineer Pennsylvania Railroad, New York, referred briefly to the Norfolk & Western electrification, the first split-phase locomotive of which had just been tested at Pittsburgh. The electrified section will be ready for experimental runs in the autumn and will be completed in the early winter of 1914. With steam operation it is customary to use three Mallet engines, consisting of a head engine, helper and pusher. This combination will be replaced by a front and a rear electric locomotive. Each locomotive is a double unit weighing 150 tons, of which 110 tons is carried on the drivers. The locomotives are carried on six driving wheels with a pair of trailing wheels at each end. Guiding wheels are used because the curvature amounts to fully 42 per cent of the total trackage. The maximum drawbar pull of a half locomotive is 48,000 lb. during acceleration and 38,000 lb. during running. The maximum tractive effort of 62,500 lb. is equivalent to a drawbar pull of 100,000 lb. at the head of the train during acceleration, or five times the figure admissible on the Swiss Railways. Single-phase energy at 44,000 volts will be transmitted to the 11,000-volt contact line from a power house containing 9000-kw single-phase generators. On the locomotives a phase converter and transformer are employed to transform the current for use in three-phase traction motors.

The Pennsylvania Railroad is co-operating with the Westinghouse Electric & Manufacturing Company and the New York, New Haven & Hartford in adapting the mercury rectifier to locomotives. The Pennsylvania Railroad has loaned the Westinghouse company a standard steel car which is equipped with four 225-hp motors. A mercury rectifier and transformer have been placed in the baggage compartment for the experimental service. After very promising trials at Pittsburgh for some months, the car is now in experimental service on one of the lines of the New Haven company.

In concluding his remarks Mr. Gibbs expressed his disapproval of the tendency of electrical manufacturing companies to identify themselves exclusively with some one system of electrification. He complimented the manufacturers highly on the splendid work they have done in developing the apparatus, but felt that only the user and his consulting engineer can make a decision which will be free from commercial bias. He claimed that the tactics of an engineer-salesman should not be presented in the guise of engineering advice.

Mr. A. H. Armstrong, engineer railway department of the General Electric Company, did not agree with Mr. Gibbs that the engineer of a manufacturer is prejudiced as to systems of electrification. In fact, he said, such an engineer is likely to lean backward in his desire to avoid such a charge. As an example of satisfactory consulting engineering work by manufacturers he mentioned the 2400-volt direct-current electrification of the Butte, Anaconda & Pacific Railway, on which loads of 4000 tons are being hauled.

Mr. W. S. Murray, consulting engineer New York, New Haven & Hartford Railroad, described briefly the 22,000-volt balanced redistribution system which had been installed on the New Haven Railroad to eliminate electromagnetic effects on adjacent telephone and telegraph lines. The function of the new distribution system is to break up the cause of the disturbing lines of force. Mr. Murray stated that on the day that the system was changed over he stood in the Cos Cob power house at a telephone receiver connected to the Harlem River yards at New York, 25 miles away. With the original system in use he could not hear distinctly. After the 22,000-volt system had been substituted he could distinguish no difference in the clearness of the telephone transmission during a period of four hours while the load was varying from zero to 23,000 kva. Under the new system 11,000 volts are carried in each wire, but the total difference of potential between the two sides of the circuit is 22,000 volts. The rails act as if they formed the neutral conductor of a three-wire system. Auto transformers are used to transfer the return current from the rail to an aerial circuit connected with the power house.

Mr. N. W. Storer, Westinghouse Electric & Manufacturing Company, described the articulated double-truck locomotives of the Norfolk & Western Railway with the aid of a series of slides. In this locomotive use is made of the parallel-rod drive common to steam locomotives, the transmission from each pair of motors being obtained through one jackshaft. The first locomotive has been on the test track at Pittsburgh for six weeks, and the entire system has operated perfectly. All the weight is spring-supported to the same

extent as in steam locomotives. The electrical characteristics of the locomotives are, of course, the same as those of a straight three-phase machine. The Norfolk & Western type was designed for the fixed speeds of 14 and 28 miles per hour. Originally cascade motors were provided to give the additional speed of 7 miles per hour, but the railway requested that this be omitted as too low for service.

The phase-converter itself is an induction motor with a squirrel-cage winding driven by single-phase current from the transformer, the other phases being obtained by automatically shifting taps of a transformer on the principle of the Scott two-phase, three-phase method. This type of machine is particularly desirable for heavy freight service, because it gives the same speeds on down-grades and up-grades. The one-hour rating of each locomotive is 1650 hp at 14 miles per hour and 2000 hp at 28 miles per hour.

A feature of the motor construction is that the stator and armature can be lifted bodily from the machine and that the armature bearings are carried in the side frames of the locomotives. The motor is of the standard induction type, the rotor having three collector rings on each end. The winding is as solid as an induction motor winding can be. The phase converter is provided with a starting motor to bring it up to speed. The phase converter also drives the fan motors and the compressor. The changes from the eight-pole to the four-pole combination are made by means of a commutating switch operated by compressed air.

Public Utility Regulation Discussed by Western Society of Engineers

Three papers relating to public utility regulation were read and discussed at the meeting of the Western Society of Engineers of Chicago on March 16. The meeting was held to discuss further the subject of reasonable charges for public utility service, which was the theme of an instructive paper read by Dean M. E. Cooley of the University of Michigan at the annual meeting of the society and summarized in the *Electrical World* of Feb. 14 last, page 356.

The first paper was read by Mr. Andrew Cooke, who considered public utility regulation from the investor's point of view.

Mr. Samuel O. Dunn, editor of the *Railway Age Gazette*, read a logical and clearly presented paper on public utility valuation from the railway point of view. The speaker argued vigorously for a fair allowance for going value and concluded by saying that he felt very confident that when the government valuation of the railways of the United States is made it will result in an advance in rates rather than in a reduction.

Mr. Harold Almert, a consulting engineer, was the third speaker. He discussed public utility regulation from the points of view of the public and the engineer.

Mr. John W. Alvord, past-president of the society, was called upon to open the discussion. He remarked that about a billion dollars' worth of property will be appraised annually in the next five to eight years. The fundamental principles of appraisal work rest in the law and in such questions as the definitions of property, value, etc. In this work the law should be regarded as the foundation, engineering judgment as the superstructure, and the work of the economist and business man as giving the finishing touches to the edifice.

Mr. William B. Jackson, consulting engineer, said that what the utility earns is not so important to the citizen as what it does with its earnings after it has earned them.

Mr. James E. Quan, chairman of the State Public Utilities Commission of Illinois, was called on, but retired in favor of Mr. Walter A. Shaw, the engineering member of the commission. Mr. Shaw spoke briefly, assuring his hearers that the Illinois commission would give the utilities a fair compensation on a fair valuation.

Mr. L. E. Cooley, consulting engineer and brother of Dean Cooley, said that if he had his way the utility would be financed with only one security. This one security would bear only a minimum rate of interest until the utility was a going concern, and other issues of the security would be put out during the early years to cover possible losses. When the utility was on its feet and a prosperous, going concern, the security would then have a fair return allowed to it, all over that to be turned into a surplus fund to provide for amortization or improvement to the property.

Mr. A. C. King, deputy commissioner of gas and electricity of Chicago, spoke briefly, and was followed by Prof. Morgan Brooks, of the University of Illinois, who dwelt particularly on quality of service rather than reduction of rates. Mr. Onward Bates, a past-president of the society, contributed a written discussion.

To Urge Electric Vehicles for Parcel-Post Service

To encourage the general use of electric vehicles in parcel-post delivery service the Electric Vehicle Association of America, co-operating with the National Electric Light Association, has undertaken a comprehensive campaign of education on electric delivery topics and in this effort is enlisting the interest and assistance of the post office authorities at Washington, members of Congress, central-station executives, manufacturers and local postmasters.

The inauguration of the parcel-post service, together with its later extensions, has made necessary at short notice extensive local delivery equipment. In two cities, New York and Indianapolis, Ind., the local contractors have had electric trucks in use, and the records of these vehicles (as reported in the *Electrical World* of Jan. 10 and 17) have been so satisfactory, from the viewpoints of economy, reliability and general performance, that the widest interest has been aroused in the "electric" as the logical means of conveyance for parcel-post delivery in other cities.

The present campaign of the Electric Vehicle Association has been placed by President F. W. Smith in charge of a special committee on parcel-post delivery, comprising Mr. James H. McGraw, chairman, president of the McGraw Publishing Company, New York; Mr. C. A. Terry, vice-president Westinghouse Electric & Manufacturing Company, New York; Mr. E. S. Marlow, manager commercial department Potomac Electric Power Company, Washington, D. C.; Mr. W. P. Kennedy, consulting transportation engineer, New York; Mr. S. G. Thompson, Public Service Electric Company, Newark, N. J., and Mr. O. H. Caldwell, *Electrical World*, New York.

To co-operate with the above committee on behalf of the National Electric Light Association, President J. B. McCall, Philadelphia, Pa., has appointed Mr. Frank W. Frueauff, president of the Denver Gas & Electric Company, chairman of a committee the other members of which are Messrs. C. L. Edgar, president Edison Electric Illuminating Company, Boston, Mass.; Arthur Williams, general inspector New York Edison Company, New York; L. A. Ferguson, vice-president Commonwealth Edison Company, Chicago, Ill.; J. A. Britton, vice-president Pacific Gas & Electric Company, San

Francisco, Cal.; W. W. Freeman, general manager Union Gas & Electric Company, Cincinnati, Ohio; Frank M. Tait, president Dayton Power & Light Company, Dayton, Ohio; T. W. Peters, commercial manager Columbus Power Company, Columbus, Ga., and T. I. Jones, general sales agent Edison Electric Illuminating Company, Brooklyn, N. Y.

That the case of the electric vehicle in parcel-post service may be adequately presented, the joint committee has just issued a sixteen-page pamphlet "The Electric Vehicle in Parcel-Post Service for Economy and Reliability," which is illustrated with a number of pictures showing fleets of electric cars used by government departments, city department stores and express companies. The text of the booklet is taken up with a statement of some of the problems of parcel-post delivery, brief sketches of the co-operating associations, the E. V. A. and the N. E. L. A., and an enumeration of the advantages of the electric vehicle for the service required.

One of the purposes of the booklet is to make known the many and particularly interesting reasons, not yet fully appreciated, why the electric vehicle has superior advantages over any other type for transportation within the limitations of city and suburban service, as distinguished from either long-distance service or rural delivery. The electric machine, it is pointed out, has been evolved under the most rigorous and exacting service during the past fifteen years. As a successful device in quantity installations for commercial purposes it has commanded the indorsement and the investment of the merchant community to a greater extent than any other kind of motor vehicle.

Many millions of dollars have already been invested in electric commercial cars by the most conservative business organizations in the country, including express companies and others to whom reliability of transportation equipment is of vital importance. No corresponding collective investments have ever been made in any other type of commercial motor vehicle.

Wherever they have been installed within the field of their rational application electric trucks have not only remained but by reason of their economy have forced increase in their number. For some years they have been successfully employed in considerable numbers by many government departments, including the Navy Department, Treasury Department, Government Printing Office, the Insular Bureau and by some contractors in the service of the Post Office Department.

An approximation of the value of some of these large investments is as follows: Express and transfer companies, $3,010,000.00; public-service companies, $3,671,000.00; department stores, $5,627,000.00; packing-house organizations, $609,000.00; brewers, $5,350,000.00; wholesale merchants and manufacturers, $2,088,000.0; United States government service, $435,000.00.

Were electric-vehicle installations established in various cities of the country the Post Office Department would be assured that the local public-service electricity supply companies would exert a particular fostering influence to insure the successful, uninterrupted and economic service of these installations whether they are owned and operated by contractors or owned and operated by the department. Should the policy of department ownership be determined upon, this local co-operation would be the greatest possible insurance which the department could have against risk, while if the continuation of the existing contract method should be decided upon the co-operative efforts of the sister associations would be of particular value in furthering plans by which the contractors could secure and successfully employ electric equipment.

ELECTRIC TRUCKS OF THE GOVERNMENT PRINTING OFFICE, WASHINGTON

In Europe there are still some few survivals of the numerous forms of motor-bicycles, etc., but the more conservative governments are now inclined to employ the electric vehicle on account of its economic advantages, notwithstanding the fact that in Europe the "electric" has been only partially developed, compared with the status of the industry in this country.

FLEET OF ELECTRIC TRUCKS, AMERICAN EXPRESS COMPANY, NEW YORK

Electric vehicles have superseded gasoline machines in Vienna, where forty-five 2.5-ton machines have been placed in service after fifteen months' test covering 312,500 car-miles. Electric vehicles are also used in considerable numbers for postal service in Berlin, Munich and Leipzig, and while gasoline machines are used in these latter cities, and also in Paris, Rome and Budapest, the electric is under observation for its economic advantages. Great Britain has 170 motor-vehicle mail-service contracts, nearly all of which are for long-distance transportation. The booklet closes with data showing the comparative economy of the New York and Indianapolis installations of parcel-post trucks.

(See the *Electrical World* for Jan. 10 and 17, 1914.)

Copies of the pamphlet are being sent to officials of the Post Office Department at Washington and to members of the Senate and House of Representatives. Other copies are being forwarded to central-station executives in towns of over 5000 population, with the request that they bring the topic to the attention of both their congressmen and their local postmasters. Postmasters in cities of 10,000 and over will also receive the pamphlets.

Characteristics of Saturated and Unsaturated Vehicle Motors

At the meeting of the Electric Vehicle Association of America at New York, March 24, Mr. T. H. Schoepf, of the Westinghouse Electric & Manufacturing Company, presented a paper on "The Performance Characteristics of Electric Motors and Their Influence on the Operation of Electric Trucks."

TABLE I—TRUCK WITH SATURATED MOTOR

Length of Run in Miles	Time in Seconds: Power On	Time in Seconds: Total	Average Speed, M.P.H.	Average Amperes	Amp-Hours	Watt-Hours	Watt-Hours per Ton-Mile	$\sqrt{\text{Mean Amp.}^2}$
⅛	64.4	84.5	7.09	57.0	1.02	81.6	103.2	59.5
¼	102.5	122.9	7.31	55.6	1.58	126.8	106.5	58.0
⅜	139.7	160.0	7.5	55.0	2.13	170.4	107.9	56.4
½	215.0	235.7	7.65	54.9	3.23	258.2	108.9	56.0

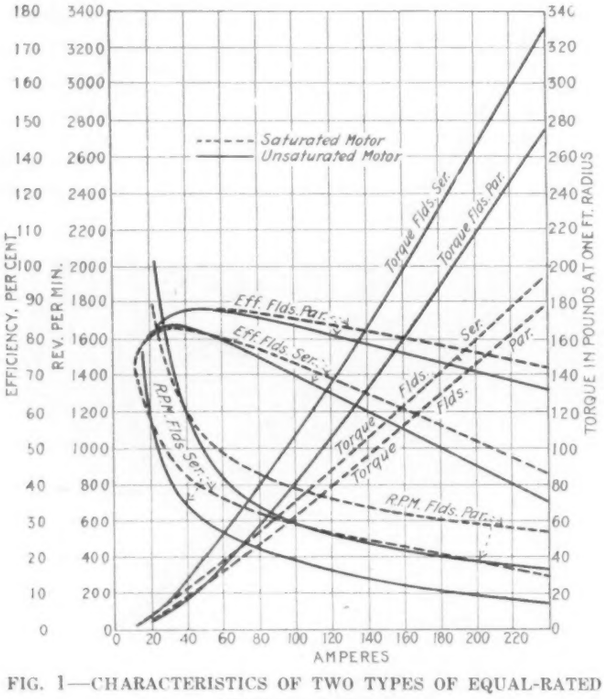


FIG. 1—CHARACTERISTICS OF TWO TYPES OF EQUAL-RATED VEHICLE MOTORS

His paper dealt with magnetically saturated and unsaturated motors, pointing out briefly the extent to which these magnetic qualities should be developed. The maximum torque ratio which can be obtained theoretically from a normal series or unsaturated motor is 6.25, but such a motor is impracticable as it would be very large and heavy and would be expensive per rated horse-power.

Where high speeds are desired at normal loads even with an increased current input and with a sacrifice of the ultimate car-miles obtainable per battery charge, a saturated motor should be employed. If the main object is to secure a large number of car-miles per battery charge even though the speed drops excessively at normal overloads, an unsaturated motor is preferable.

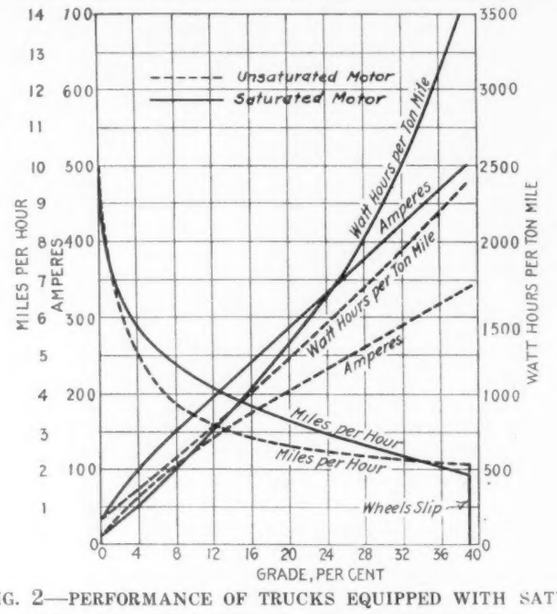


FIG. 2—PERFORMANCE OF TRUCKS EQUIPPED WITH SATURATED AND UNSATURATED MOTORS ON GRADE

The characteristic curves shown herewith are obtained with 80-volt, 40-amp, 1200-r.p.m. motors, the saturated type having torque and speed ratios of 3.0 and 0.65 respectively, while the unsaturated motor had ratios of 4.9 and 0.47. The truck assumed in these computations weighed 9500 lb. loaded and had wheel diameters of 36 in. and a total speed reduction of 14.3 to 1. Sixty-five per cent of the truck weight was assumed to be on the driving wheels, and 62 per cent was chosen as the coefficient of adhesion.

TABLE II—TRUCK WITH UNSATURATED MOTOR

Length of Run in Miles	Time in Seconds: Power On	Time in Seconds: Total	Average Speed, M.P.H.	Average Amperes	Amp-Hours	Watt-Hours	Watt-Hours per Ton-Mile	$\sqrt{\text{Mean Amp.}^2}$
⅛	70.9	77.2	6.88	53.1	1.05	83.6	105.8	54.0
¼	110.8	127.7	7.06	51.2	1.57	126.0	106.0	53.4
⅜	149.0	165.8	7.25	50.8	2.10	168.2	106.3	53.0
½	227.8	244.5	7.36	50.5	3.20	256.0	107.8	52.5

In the discussion the following took part: Messrs. D. A. Baldwin, General Electric Company; R. McA. Lloyd, International Motors Company; E. W. M. Bailey, S. R. Bailey & Company, Inc.; P. D. Wagoner; F. S. Dellenbaugh, Westinghouse Electric & Manufacturing Company; H. H. Smith, Edison Laboratories; H. E. Pratt, Gould Storage Battery Company; Artemus Ward, New York; R. L. Lloyd, Philadelphia; J. F. Becker, New York, and others. A general opinion was expressed that saturated motors are preferable for passenger vehicles, and unsaturated motors for commercial vehicles as they are more foolproof. It was urged that an effort be made by the association to establish the term "passenger car" instead of pleasure vehicle.

Municipal Ownership and Holding Companies

At the West Side Branch of the Young Men's Christian Association in New York on March 23 an explanation of the disadvantages of municipal ownership of public utilities was given by Mr. Arthur Williams, of the New York Edison Company. The speaker was introduced by Mr. A. W. Burchard, who discussed briefly the relations between the various lines in which Mr. Williams has been prominent.

Municipal ownership was shown to be impracticable because it has not been a success in foreign countries and because it has not so far achieved the same record in this country as the privately owned plant. Mr. Williams divided utilities into two main classes, the first embracing such services as street cleaning and the maintenance of parks, buildings, sewers, police and fire departments, while the second includes railroads, electric service, gas, street-railway and also possibly water service. He said that the first group lends itself easily to municipal ownership and operation, although cases of private ownership of such utilities are not uncommon. The second group, he thinks, cannot be operated by the government, because the required talent for efficient operation cannot be obtained at government salaries and under the conditions of frequent change that characterize government in this country. Civil-service organizations are thought by Mr. Williams to form a serious menace to municipally operated enterprises, since they can tie up service by united action.

A number of instances were cited by Mr. Williams of the failure of municipally owned utilities at home and abroad, and in each case an analysis was made of the reasons back of the failure. In conclusion he stated that the public service commission offers a remedy for defects in private ownership and operation.

Holding Companies

At a lecture on March 16 Mr. Francis T. Homer, of Bertron, Griscom & Company, presented an interesting paper on the subject of public utility holding companies. This paper opened with a discussion of the several forms of holding companies, and the subject was limited so as to exclude consideration of such combinations in the manufacturing, commercial and railroad fields.

The main point which Mr. Homer sought to bring out in his talk was that the public utility holding company is fundamentally different from the holding company in any other line of industrial activity, in that public utility operations form a natural monopoly. While real competition in other lines has a tendency to result in lower prices to the public and an improvement of the service, he stated that competition in the public utility field tends to duplication of plant and a corresponding increase in the cost of the service.

The last part of Mr. Homer's address was given to an exposition of some of the advantages of the holding company in the public utility field. He thinks that the systematic tabulation and comparison of costs and receipts of the several subsidiary companies in such an organization works toward the most efficient and scientific operation of the same, and more than replaces the stimulating effect of local competition. From the engineering standpoint, he claims that advances can be made by the combining of resources of a number of companies which could not be achieved by the same concerns working individually, and the advantages of standardization can be obtained to an extent that separate organizations could not hope to obtain them. Other advantages mentioned for the holding company were the possibility of a larger and better legal department, the obtaining of better results through the purchasing department by the securing of discounts and wholesale prices, and the financial advantages secured through the institution of uniform methods of accounting. Some but not all of these advantages, according to Mr. Homer, are possessed by the management company form of operation.

Testimony on Trust Legislation

Testimony is still being heard by the judiciary committee of the House of Representatives in regard to pending trust legislation.

Mr. James F. Jackson on Interlocking Directorates

Mr. James F. Jackson, of Boston, called attention to the way in which the proposed legislation on interlocking directorates would affect certain local state-regulated public utilities. He assumes that the principle is settled that such directorates are objectionable in cases where railroads, telephone companies, telegraph companies or other interstate corporations would realize therefrom a power that would interfere with competition. The public utilities discussed by Mr. Jackson are necessarily monopolies and subject to regulation.

Mr. Jackson argued that where a state regulates issues of stocks and bonds no danger can come to the public from the presence of a banker on the board of directors of the company. Mr. Jackson criticised the suggestion that the law should not apply to companies in communities of less than a certain figure in population or to companies having less than a certain amount of capital.

Mr. Frederick P. Fish Urges Commission Study

Mr. Frederick P. Fish, of Boston, said that he was firmly convinced that the patent system of the United States is the mainstay, and almost the only mainstay, against an innumerable number of influences which adversely affect industrial development and prosperity. He urged the committee to give full consideration to that question before injecting into the situation any attempt to modify the substance of the patent law. That requires special investigation.

In regard to the general legislation purpose, Mr. Fish declared that he could not help feeling that the committee should carefully consider whether at the present time there is, to anything like the extent there was ten years ago, the occasion for drastic measures.

The most serious element of the business situation to-day, Mr. Fish added, is the tendency toward extravagant and destructive competition. Business men have instinctively tried to meet this evil and in doing so have fallen, through want of adequate experience, into ways that were not consistent with the public interest. The good in the resulting Sherman law may be saved and its harmful tendencies eliminated.

Mr. Fish renewed the suggestion which he has made that the whole matter be studied thoroughly by a strong commission before further legislation is enacted. He thought that new legislation may be ill-advised and that it is not necessary. If anything is to be done, however, he would like to have the Sherman law amended so that it would mean clearly what the Supreme Court, as he understood, construes it as meaning, which is that no agreement in restraint of trade is unlawful and punishable unless it is to the detriment of the public. He believes that it is perfectly proper for retailers, wholesalers and manufacturers to have trade understandings provided they are not contrary to sound morals.

Other Matters Before the Committee

Mr. Horace Stern, attorney of Philadelphia, discussed the methods of the German government in dealing with combinations and presented numerous data on this sub-

ject. In referring to the various cartels he mentioned the sales office of the united manufacturers of electric lamps in Berlin, organized in 1903.

A letter from Mr. E. R. Stearns, of Cincinnati, Ohio, addressed to Mr. A. Lee Thurman, solicitor of the Department of Commerce, was incorporated in the record. Mr. Stearns said that, as a stockholder in the Cleveland Electric Illuminating Company, he would like to see its control taken out of the hands of a holding company.

The Electrical Merchants & Manufacturers' Association, through Mr. P. C. Burns, president, sent a letter to Representative Allen which was incorporated in the record. It called attention to a condition in restraint of trade "caused by telephone operating companies using their shops, warehouses, exchange managers and other employees for the sale of merchandise throughout the United States in direct competition with merchants and manufacturers not having any special privileges or franchises from the government, thereby destroying legitimate competition." The letter requested that a provision be incorporated in the law to stop this practice. The letter referred to the control of the Western Electric Company by the American Telephone & Telegraph Company. A somewhat similar request was made by Mr. Garrison Babcock, general manager the Telephone Improvement Company of Chicago.

Rates and Negotiations in California

The Southern California Edison Company has reduced its maximum rate for Los Angeles, Riverside, San Bernardino, Orange and Kern Counties from 8 to 7 cents per kw-hr. These rates do not apply in the city of Los Angeles, where lower rates exist.

The Southern California Edison Company has established, with the approval of the Railroad Commission of California, a new schedule of rates for electric light and power service in certain localities in the county of Los Angeles. For incandescent lighting the rate for the first 100 kw-hr. or less of energy furnished in any one month to any consumer is to be 5 cents per kw-hr. The rate decreases with the increase in consumption to 3 cents per kw-hr. for energy of over 2000 kw-hr. Free renewals of metallized-filament lamps and carbon-filament lamps are given.

For arc lighting the rate for the first 100 kw-hr. or less is 4.9 cents per kw-hr. The minimum rate is 4 cents per kw-hr. for more than 500 kw-hr. A minimum monthly charge of 60 cents per meter of 3 kw rating or less and 30 cents for each additional kilowatt of meter rating required shall be made for each meter.

For motor service the rate is 4 cents per kw-hr. for the first 100 kw-hr. It decreases to 1.2 cents per kw-hr. for over 3000 kw-hr. There is a monthly minimum charge of $1 for 1.5 kw equipment rating or less and 75 cents for each additional kilowatt required.

Messrs. John B. Miller, president of the Southern California Edison Company; William Baurhyte, vice-president of the Los Angeles Gas & Electric Corporation, and G. C. Ward, vice-president of the Pacific Light & Power Corporation, have joined in a letter to the City Council of Los Angeles, Cal., in regard to the plan of the city to lease the energy-distributing systems and assume independent possession. They say that their attorneys are unanimous in the opinion that the contract desired by the city would violate the covenants of the trust deeds securing outstanding bonds. In addition to this difficulty, the engineers for the companies say that there would be no way of keeping the property of the companies and the additions to be made by the city from inseparable entanglement.

The letter outlines a plan under which the companies are willing to enter into a contract providing for the use of their distributing systems for the distribution of such energy as the city may generate and for eventual sale to the city of the distributing systems within the city and adjoining territory.

Wisconsin Conference on Electrical Rules of Safety

Responding to an invitation from the Industrial Commission of Wisconsin, about thirty-five electrical men attended a conference held in the State Capitol at Madison, Wis., on March 13. The purpose of the hearing was the consideration of tentative rules, or orders, which the Industrial Commission of Wisconsin may promulgate better to insure the safety of men employed in electrical work or near electrical apparatus. These "Orders for Safety in Electricity," constituting the more important part of a proposed electrical code, have been prepared by a committee of seven men representing electrical manufacturers, central-station companies, contractors and working electricians. The committee has given several months of careful study to the preparation of the tentative "orders." It is said that Wisconsin is the first state to have any electrical code in preparation.

Mr. C. H. Crownhart, chairman of the commission, called the meeting to order. He explained the course of procedure which is followed by the commission. The electrical rules have been formulated in their present tentative shape, he said, by a committee of experts. When they are finally adopted and promulgated by the commission they will have the force and effect of law. In the meantime the freest criticism and discussion are invited. Mr. Crownhart requested Mr. P. A. Schroeder, as chairman of the electrical committee, to preside at the hearing. The proposed orders are numbered from 600 to 629, inclusive. They were taken up section by section and read by Mr. Price, the secretary of the committee.

The proposed rules had to do chiefly with overhead-line construction and with provisions of safety within and without generating stations. Telephone and telegraph men complained of the lack of consideration given to both these branches of the electrical industry in the formulation of the rules, and provision was made to give adequate hearing to their grievances. Considerable discussion arose over the question of what was and what was not a dangerous voltage, the committee having set the limit of safe voltage at 300 volts. Those taking part in the discussion were Messrs. William Bennett, superintendent of telegraphs of the Chicago & Northwestern Railway Company; H. E. Bloomer, inspector for the Milwaukee Board of Fire Underwriters; R. S. Hartley, of Superior; E. J. Hutchins, division plant engineer Western Union Telegraph Company, of Chicago; C. M. Jansky, of the University of Wisconsin; E. H. Kifer, of the Madison Gas & Electric Company; L. H. Lathrop, of the Menominee & Marinette Light & Traction Company; M. G. Lloyd, of the *Electrical Review and Western Electrician;* C. R. Phenicie, of the Wisconsin Public Service Company; H. O. Seymour, of the Wisconsin Telephone Company, and W. L. Smith, president of the Wisconsin Telephone Association. Messrs. C. H. Crownhart and J. D. Beck, members of the industrial committee; J. N. Cadby and P. B. Turner, of the Wisconsin Railroad Commission, and T. E. Barnum, S. B. Way, W. F. Gute and C. W. Price, members of the committee which drew up the tentative orders, also participated in the discussion upon the proposed rules.

Joint Engineering Meeting in Milwaukee

The second joint meeting of technical societies of Wisconsin held in Juneau Hall of the Auditorium Building, Milwaukee, on March 21, was a successful affair. Sixteen societies, or sections of national societies, participated, including the Milwaukee and Madison Sections of the American Institute of Electrical Engineers, the Milwaukee Section of the American Electric Railway Association, the Milwaukee and Madison Sections of the American Society of Mechanical Engineers, the Chicago Section of the Illuminating Engineering Society, the Milwaukee Electrical League, Wisconsin Jovians and members of general engineering societies, as well as chemists, architects and gas engineers. Mr. Lewis E. Bogen, chairman of the Milwaukee Section of the American Institute of Electrical Engineers, presided. The other members of the program committee were Messrs. Francis A. Vaughn and Arthur Simon. The attendance was perhaps 300 or 350.

The first paper was by Mr. Alfred O. Crozier and was on "Cement and Clay Products Contrasted." This was a plea for wet-process cement products as contrasted with clay products. Mr. Bogen spoke of the remarkable extension of the use of concrete in power-house design and also in the construction of switchboards, oil-switch compartments and the like.

Significance of Wisconsin Public Service Commission Law

Prof. R. C. Disque, of the University of Wisconsin, read a scholarly paper entitled "The Historical Significance of the 1907 Wisconsin Law for the Regulation of Public Utilities." The author said that the law establishing the present commission system of the regulation of public utilities in Wisconsin has so far reasonably met the hopes of its sponsors and has been copied by similar laws in half of the states of the Union.

The law treats the problem as a two-sided regulation—that is, regulation which was to be for the benefit of all concerned. Valuation was required in the Wisconsin law. Two new ideas were introduced in this law—the abolition of the term "franchise" and the prohibition of the establishment of a second utility where a good one already exists. The Wisconsin law provides machinery for recognizing and enforcing the common-law rights of utilities. It is radical in the sense of going to the root of the matter rather than being any step outside of the evolution of regulatory doctrine and practice.

Among those taking part in the discussion were Prof. John G. D. Mack, University of Wisconsin; Prof. Edward Bennett, University of Wisconsin; Mr. John N. Cadby and others connected with the staff of the Railroad Commission of Wisconsin; Dr. M. G. Lloyd, chairman of the Chicago Section of the Illuminating Engineering Society; Mr. Ewald Haase, president of the Wisconsin Gas Association, and Mr. W. B. Voth, superintendent of the Sheboygan Railway & Electric Company.

Gas Measurements and Panama Canal Switchboard

Mr. J. C. Wilson, of Milwaukee, gave an illustrated talk on "The Measurement of Gases in Large Quantities." One feature was a brief description of the Thomas electrical method of measuring gas, which involves the introduction of electric heat into the gas pipe and electric measurements to determine the temperature of the gas before and after heating. Luncheon was taken at the Republican House, and Mr. A. A. Gray, of Chicago, gave a talk at that time. The first feature of the afternoon session was a motion picture illustrating the electrical control of the Panama Canal locks. These pictures were taken, apparently, in the General Electric works at Schenectady before the apparatus was shipped to the Canal Zone.

Street Lighting and Illumination

An illustrated paper on "Principles of Street Lighting," prepared by Messrs. Arthur J. Sweet and Francis A. Vaughn, Milwaukee, was presented by Mr. Sweet. The authors discussed the silhouette, direct-illumination, glint and shadow effects of street lighting. Of these the direct-illumination effect, throwing the light on the object, is the most important. Much was said in the paper about uniform illumination in street lighting, and the authors declared that the spacing between street-lighting units should be not more than four times the mounting height.

Mr. John Hayes Smith, of Milwaukee, read a paper entitled "Principles of Illumination." The author said that illuminating engineers do not take sufficient cognizance of the physiology of the eye. He criticised low-hanging street lamps.

Iron Manufacture and Machine Tools

Mr. G. F. Ahlbrandt gave an illustrated description of the manufacture of pure-iron products. In the plant illustrated electric traveling cranes, electric charging machines and lifting magnets were shown. The speaker said that the corrosion of iron is an electrolytic process. Pure iron is used, among other things, for transformer tanks. Mr. Wood, of the Lodge & Shipley Machine Tool Company of Cincinnati, gave an illustrated talk on "Special Operations on Machine Tools."

Recent Power-Plant Developments

Prof. A. G. Christie, of the University of Wisconsin, presented an illustrated lecture on "Developments in American Power-Plant Machinery." In the boiler room, he said, efficiency lies not in the boiler itself, but in the setting, the draft and the furnace construction. Professor Christie thinks that boilers have been set too low down. He referred briefly to water softeners and said that he thought they should receive more consideration than has been given to them by designing engineers. In relation to pumps, he asked if it might not be possible to use sheet-metal valves in them. Considerable attention was paid to steam-turbine practice. The combined Curtis-Rateau construction used in large units abroad was mentioned and also the characteristics of the Parsons type. The speaker said that non-condensing steam turbines are coming in the larger sizes. The vertical Curtis turbines will gradually disappear, he thinks. Blade failures in steam turbines are generally to be accounted for by increased speeds.

Professor Christie gave some consideration to the barometric type of condenser and described briefly the new Allis-Chalmers jet condenser, the La Blanc condenser, and also improvements in surface condensers, air pumps, etc., including foreign rotary air pumps. The Lentz steam engine and the new uniflow type of engine were mentioned, and the speaker devoted considerable time to the locomobile, or Buckeyemobile, as this type of combined boiler and engine is called by one American manufacturer.

The concluding portion of the author's paper related to the mercury boiler and turbine proposed by Mr. W. L. R. Emmet, of the General Electric Company. The idea here is to utilize temperatures impossible with steam boilers and turbines. One difficulty is in confining the mercury vapor, which is very elusive. The apparatus so far set up for carrying out this idea is tentative, but the whole investigation is very interesting. The mercury vapor is condensed, and the type of condenser proposed was also briefly described by Professor Christie. In the evening Dr. Herbert N. McCoy, of the University of Chicago, gave an illustrated lecture on radium.

Radio-Telegraph Patents Litigation

The decision of the United States District Court for the Eastern District of New York in the recent patent suits brought by the Marconi interests against the National Electric Signaling Company, of Pittsburgh, has aroused much interest in radio-engineering circles. In a lengthy and carefully written opinion dated March 17,1914, Judge Van Vechten Veeder finds the defendant guilty of infringement of Lodge's United States patent No. 609,154 and Marconi's No. 763,772, and holds Marconi's original patent No. 586,193 (the re-issue, No. 11,913, being in suit) valid but not infringed. The daily press throughout the country has stated repeatedly that the effect of this decision is to give the Marconi Wireless Telegraph Company of America a comprehensive monopoly of radio-telegraphy in the United States. Government officials and others who are possessed of full information in the matter do not, however, appear to hold so sweeping a view of the immediate result, especially since appeals to the higher court are being prepared on both of the later patents.

The conclusion of litigation, or at least of the second step in litigation of the original Marconi patent, marks a definition of scope of claims which is of great importance to all workers in radio signaling. This patent, re-issued as No. 11,913 (original filed Dec. 7, 1896, and issued July 13, 1897), was the basis of a suit against the De Forest Wireless Telegraph Company, and in 1905 was sustained as to Claims 3 and 5, though Claim 1 was invalidated. In the present case Claim 3 only was pressed, and this reads as follows:

"3. The combination, in an apparatus for communicating electrical signals, of a spark producer at the transmitting station, an earth connection to one end of the spark producer, an insulated conductor connected to the other end, an imperfect electrical contact at the receiving station, an earth connection to one end of the contact, an insulated conductor connected to the other end and a circuit through the contact, substantially as and for the purpose described."

Experts for the Marconi company construed this claim very broadly, urging that the patent disclosed the first use of a grounded antenna system for radio-telegraphy and that it therefore should be held to cover all uses of such ground-and-aerial-wire circuits. It is understood that the National company based its position of non-infringement upon the limiting clauses of the claim as to a "spark-producer with one end connected to earth" and an "imperfect contact . . . as described."

Judge Veeder accepted the defendant's views of this matter and says in his opinion:

"I find that the evidence establishes Marconi's claim that he was 'the first to discover and use any practical means for effective telegraphic transmission and intelligible reception of signals produced by artificially formed Hertz oscillations.' . . . Marconi accomplished his result by combining, in the utilization of known principles, features which had been disclosed by others, which he improved and co-ordinated, with additional features of his own invention. . . .

"With respect to infringement, it appears that the defendant's transmitting station is inductively connected with an oscillating path from antenna to ground. . . . At the receiving station the antenna is permanently connected in a closed circuit to ground. . . . The local oscillation circuit comprises one coil of the transformer, a condenser and either an electrolytic or a crystal detector. . . .

"In the defendant's device the spark-gap and detector are not in the antenna at all. . . . When the complainant's expert Waterman was asked which one of the ends of the detector . . . was connected to ground, he admitted that he would have to say that it was not connected with the ground at all. . . . Marconi's claim was, not for a grounded connection in general, but for a particular connection, which the defendant does not use.

"It seems equally plain to me that the defendant's electrolytic and crystal detectors do not infringe the complainant's imperfect contact device or coherer. . . . The defendant's detectors do not operate in the same manner as the Marconi coherer. . . .

"Giving the claim in issue, therefore, the broadest construction to which it can possibly be entitled, it seems clear to me that it is not infringed by the defendant. Accordingly I find that the claim, although valid, is not infringed."

Thus the court has so restricted the patent's scope that the possibility of a broad monopoly including all uses of grounded antennas for radio signaling has been set aside. Although no statement has been made by the complainant company to this effect, it is believed that Judge Veeder's decision on the re-issue patent will not be appealed. It may be noted that the patent will expire on July 13, 1914.

The second patent in suit was issued to Sir Oliver Lodge Aug. 18, 1898, on application filed Feb. 1, 1898, and had not been the basis of any litigation prior to this suit. In fact, it was not the property of the Marconi company until a short time before the present action was brought. During this suit the complainant contended that Lodge was the first to appreciate and apply the useful action of a lumped self-inductance connected between capacity areas in a radiator or absorber for radio-telegraphy. One of the capacity areas might be the ground-surface and the other the usual antenna system. The defendant company was shown to use antenna loading coils in both sender and receiver, or their equivalents in oscillation-transformer coils, so that it is inferred there could be no disagreement as to infringement if the patent were held valid and construed broadly.

The claims in issue were Nos. 1, 2 and 5, the last reading:

"5. In a system of Hertzian-wave telegraphy, the combination, with a pair of capacity areas, of a variably-acting self-inductance coil, serving to syntonize such a radiator or resonator, whereby signaling may be effected between any two or more correspondingly attuned stations without disturbing other differently attuned stations." Claims 1 and 2 call for an inductance coil in a radiator or absorber, so constituting the system one of definite electrical pitch.

The defense urged that the laws of the effect of inductance in reducing the damping of an electrical oscillating system were well known at the time of Lodge's application, and that to utilize this principle in open circuits for radio-telegraphy was not invention. In addition, the earlier work of Tesla, Hertz and Lodge himself was stated to be an anticipation.

Judge Veeder took the position that all the prior work and knowledge related only to the use of self-inductance coils in closed oscillatory circuits, and that Lodge's patented use in open circuits was entirely new to the art. In his opinion he goes on to say:

"In Lodge's experiments with his syntonic Leyden jars, in Hertz's adjustment of his ring resonator, and in all the other references relied upon by the defendant, self-induction coils had been used only in closed circuits. Such use contained no instruction upon the effect of a coil in an open radiating circuit. One might as well attempt to study articulation by observing the sign language of deaf-mutes.

"He [Lodge] was the first to realize that if he could

get a long train of waves he could afford to diminish the effect of the first few of them, the desired result being secured by cumulative effect. . . .

"It seems plain to me, therefore, that the patent in issue is valid, and that the subject matter was not disclosed by the prior art. . . .

"That the claims in issue read upon the defendant's structure admits of no doubt. Both its sending and receiving stations comprise an elevated conductor, acting as one capacity area, and the earth connection as the other, with a variable inductance coil between them for purposes of syntony."

In his discussion of the Lodge patent Judge Veeder does not refer specifically to the work of Tesla, though in other parts of his opinion he shows that he has considered this to fall within the divisions of telegraphy by induction or conduction, therefore not to be pertinent to radio-communication. As to the defense of laches, or undue delay in bringing suit, which was argued, the court says: "The fact that laches is not set up in the answer as a defense to this patent relieves me of the necessity of considering it."

Among engineers in the technical field of radio-transmission Judge Veeder's decision is causing much conflicting comment, most of it centering upon the distinction which is apparently drawn between application of a physical law to circuits which are of different construction but electrically similar. Attorneys for the defense state that the case will be taken to the Court of Appeals.

The remaining patent in issue was granted to Marconi June 28, 1904, on application filed Nov. 10, 1900, and is for the so-called "four-circuit tuning" of radio-telegraphy. The corresponding British patent (No. 7777 of 1900) was sustained in 1911 by Mr. Justice Parker in an action brought by the English Marconi company. In the present case the complainant charges infringement of fifteen claims, which were urged as covering the combination of a closed reservoir circuit with a similarly tuned open radiating circuit at a transmitter, or of an open absorbing circuit with a similarly tuned closed conserving circuit at a receiver, or of the four above-named circuits all tuned to the same period (or to multiples of each other). Claim 10 is typical of the broadest combination and may be quoted:

"10. A system of wireless telegraphy, in which the transmitting station and the receiving station each contain an oscillation transformer, one circuit of which is an open circuit and the other a closed circuit, the two circuits at each station being in electrical resonance with each other and in electrical resonance with the circuits at the other station, substantially as described."

The main defense seems to have been invalidity of the patent when interpreted so broadly as urged by the complainant. Early work of Lodge, Tesla, Pupin, Thompson, Marconi, Ducretet, Fessenden and others was cited as anticipating the alleged broad invention. Double-wave-length and coupling effects were also presented, as were proofs intended to show the patent to have been unlawfully broadened by introduction of new matter between dates of filing and issue. The court, however, finds no completed anticipation and believes the other contentions not proved. The references which had been considered (by radio-engineers generally) the strongest supports for an attack against this patent were those on the work of Fessenden and Tesla. As to the first of these, Judge Veeder says, in part:

"It is claimed that the application filed by Fessenden on Dec. 15, 1899, for his patents Nos. 706,735 and 706,736 discloses not only two circuits tuned together at the transmitting and at the receiving stations, but four-circuit tuning as well. But neither the specification nor the claims contain a word about tuning. . . . In response [to the Patent Office] to this invitation to disclose any peculiar function of the condensers or their connections, Fessenden, without any reference to the function performed by the condenser in shunt to the spark-gap at the transmitting station, stated that the purpose of the condenser at the receiving station was to reduce the current in the receiving wire without reducing the current in the coil or coils 7, so that the resistance drop is eliminated. . . . Fessenden stated, not that the purpose of this condenser at the receiving station was for tuning, but that it was for the purpose of 'obtaining as large a current as possible in the field coil 7, as this increase in current will give greater torque to the ring 8.'"

These very statements had been argued by complainant to show that Fessenden had a knowledge of tuning and its effects, since such current increases as referred to could be made only by tuning. Judge Veeder does not accept this point of view, however.

With regard to Tesla the opinion states:

"Tesla's patents . . . relate to a later conception, in which he abandoned the idea of electrostatic induction and proposed to produce direct conduction in the upper strata of the atmosphere. . . . Tesla's conception seems to be entirely remote from the subject matter in issue."

As to the equivalence of the "Tesla coil" and the oscillation transformer used in present-day instruments, Judge Veeder goes on to say:

"The Tesla coil was one having a coarse wire and a fine wire winding, and it was subject to a species of adjustment whereby the length of the fine wire winding or the size of the condenser was such as to give maximum potentials at the terminal. It was not pretended that the 'resonance' referred to in this connection was true resonance. . . . Dr. Kennelly introduced a composite sketch of what he understood Tesla's suggestions to be, as applied to wireless telegraphy. But Mr. Waterman shows that if the Tesla coil were used as depicted by Dr. Kennelly the circuit would be inoperative because the secondary would be unable to carry the energy imposed upon it and would burn out. If the coil were connected with an antenna and ground, the condition of resonance would be obliterated and the circuits into which the coil was incorporated would not be tuned circuits. . . .

"My conclusion is that the claims in issue are valid, not anticipated, and infringed."

The view of Tesla's work taken by Mr. Waterman and followed in the opinion of the court has caused a degree of astonishment in electrical fields generally, and Mr. Tesla has sent statements of protest to the daily press.

Broadly, the present decision arranges the work of Lodge and Marconi in three steps. Marconi first operated radio-telegraphy, but without any marked tuning or selecting powers on account of his rapidly damped oscillators and absorbers. Lodge then saw that persistence of oscillation was highly desirable, and, in compromising between powerful radiation and selectiveness (by the insertion of self-induction coils), sacrificed the whip-crack discharge previously sought for long distances to gain tuning. Finally, Marconi reconciled the two actions of powerful radiation and persistence due to conservation, by combining open circuits and closed ones.

The final effect of these decisions upon radio-telegraphy is not, of course, definable. It is understood that appeals or petitions for rehearing are being filed by the defendant company as to each of the two later patents, and at least until the points brought up in these are disposed of it is expected that the practice of radio signaling will remain in its present state in so far as these three patents are concerned.

Public Service Commission News

New Jersey Commission

The Board of Public Utility Commissioners has rendered a decision in the complaint of Michael Carroll and others of South Bound Brook against the Public Service Gas Company to order the extension of the company's system on Canal Street. The board refuses to order the extension unless the petitioners will guarantee the company an income sufficient to afford a return of 8 per cent on the investment involved.

Indiana Commission

An inventory of the property of the Indianapolis Light & Heat Company has been filed with the Public Service Commission of Indiana. The inventory was made by engineers under the direction of Mr. Wiley J. Huddle, of Sloan, Huddle, Fuestel & Freeman, Madison, Wis. The inventory was made by order of the commission, which is considering rates of the Indianapolis companies for light and heat. The commission expects to begin the consideration of the evidence within a short time and hearings on the valuation of the plants may be held. Whether the commission will make another inventory of the plants on its own initiative has not been made public.

A complete statement of the value of the property will be filed later, according to Mr. Charles C. Perry, president of the company.

New York Commissions

Deposits made by consumers with gas companies are the subject of a special inquiry conducted by the New York Public Service Commission, First District. The hearings will be held by Commissioner Milo R. Maltbie. The purpose is to determine whether the commission shall order companies to pay interest on deposits, to keep accurate accounts thereof, and to take other steps to protect depositors. The law requires companies to pay 6 per cent interest on such deposits, but there is no provision for annual payments, and it has been the practice of companies not to pay interest until consumers stop the service or change residence. Gas companies in the First District at the close of 1913 held $3,557,173 of such deposits, exclusive of accrued interest.

Wisconsin Commission

The Neshonoc Light & Power Company has been ordered to rehabilitate its system in accordance with certain plans suggested by the commission's engineers.

The Mineral Point Public Service Company has been authorized to issue $200,000 in 6 per cent bonds. The proceeds are to be used in paying off existing indebtedness, redeeming bonds, paying reorganization expenses and in making extensions and additions to the property. The company contemplates the extension of its high-tension transmission lines so as to reach certain mines in the vicinity of Mineral Point.

Illinois Commission

If Mr. Frank H. Funk, a member of the recently created State Public Utilities Commission of Illinois, has been correctly quoted in the Chicago daily newspapers, stocks that represent honest investment will be made safe by the new commission and honest investments will be so protected as to invite new capital into the public-utility field. Mr. Funk is credited with having said that the powers of the new commission will be exercised fearlessly with the end in view of establishing justice between utilities and the users of the service. Rates will be reduced when the facts warrant, and rates will be increased when the facts warrant. An effort will be made to correct injustice, even at the cost of inconvenience and loss, but present inconvenience will be more than compensated for by ultimate benefits. There is no occasion for alarm from any source, Mr. Funk is reported to have said. The commissioner appealed to those for whom the new board acts as arbitrator to wait with patience while the commission unfolds and puts into practice the provisions of the law.

The commission has announced that it will be its policy to deny certificates of public convenience and necessity to telephone companies where the application relates to a community which is already adequately served by a telephone company. In delivering the decision Mr. Owen P. Thompson, one of the commissioners, said that the commission believes that this policy would serve the public better than an authorization of two telephone companies in one city or village.

Ohio Commission

Mr. L. B. Denning, attorney for the Bucyrus Light & Power Company, has filed with the Public Utilities Commission of Ohio a brief regarding the valuation placed on the property. The company claims a present value of $138,233. These figures are obtained by taking as a basis the finding of Mr. Linwood G. White, engineer for the commission, and adding items for which Mr. White said he would make an allowance if he were to fix a total present value for rate-making purposes, but which he did not include in his report. Mr. White's valuation was $93,181 for the present physical value, including land. To this the attorney added $3,750 for piecemeal construction, $1,417 for interest during construction, $10,000 for preliminary financing, $5,000 for working capital and $24,885 for development expense and going value. The brief quotes Mr. Milo R. Maltbie, member of the First District New York Public Service Commission, in support of the argument that these allowances should be made. The brief declares that the portion of the law relating to the reproduction cost as of a certain date means the reproduction cost under the same conditions that existed when the property was originally constructed and that any other meaning would be unfair to both company and State. If the prices are high at the present time the company will benefit and if they are low the company will suffer. The brief discusses the question of whether early losses should be amortized or capitalized, and recommends that they be capitalized.

A complaint has been filed with the commission against the Gallia Telephone Company, Gallipolis. It is declared that the company bases its present rates upon a valuation of $108,000, while the value fixed by the Tax Commission is $55,000. The complaint asserts that a more correct valuation would be $35,000. The rates charged are $45 per year for a single business telephone, $21 for a single residence telephone and $18 for a residence party line. Reduction to $30, $15 and $12, respectively, is asked.

The commission has refused to accept the appeal of the Toledo, Bowling Green & Southern Railway Company from regulations prescribed by the City Council of Findlay to prevent electrolysis. The commission decided it has no jurisdiction in such cases. The company asked the commission to lay down rules for uniform safeguards in all cities of the State.

The commission has issued an order that all public utility companies, with the exception of steam railroads, telegraph and sleeping-car companies, must furnish an itemized valuation of their properties before Aug. 1, 1914. Cost of reproduction, depreciation and net value are to be given. Such items as overhead expenses during time of theoretical construction, value of franchises or contracts, good will, going value, cost of financing and property owned but not used may be included. This step has been taken to aid the commission in fixing valuations when it is called upon to do so and to accomplish the work in the shortest time.

Current News Notes

MARCONI WIRELESS TELEPHONE.—News comes from Sicily that the tests in wireless telephony made in the last week between warships of the Italian fleet by Mr. William Marconi were successful. The Duke of the Abruzzi presided over the experiment and expressed his admiration of the results obtained.

* * *

BROWN TELEPHONE ORDINANCE IN DENVER HELD TO BE VOID.—Judge Dennison has decided that the Brown telephone ordinance, which sought to reduce rates to telephone users in Denver, is ambiguous and void because of provisions which virtually make it a franchise. The court holds that the Mountain States Telephone & Telegraph Company is a trespasser in the city and that it is not entitled to do business until it has obtained a franchise. Further, the court says that the citizens of Denver may prescribe the manner in which the company may do business, even to the extent of fixing its rates for service.

* * *

THIRD-RAIL RAILROADS IN UNITED STATES.—A recent report made by the committee on electricity of the American Railway Engineering Association shows that on Dec. 16, 1913, there were seven third-rail railroads in the United States operating 100 or more miles of track. In order these are: New York Central & Hudson River, 234 miles; Interborough Rapid Transit of New York City, 203 miles, of which 118 is elevated and 85 subway; Long Island Railroad, 203 miles; Pennsylvania, West Jersey & Seashore, 150 miles; Northern Electric Railway of Chico, Cal., 141 miles; New York State Railways, 106 miles; Michigan United Railways. 104 miles.

* * *

THE FLOW-OVER LAMP AND THE CONSECRATED LAMP.—Central-station companies often receive queer requests from customers. The *Edison Round Table* of the Commonwealth Edison Company, Chicago, reports that a consumer called recently at the lamp-renewal department of that company and asked to have shipped to him a flow-over lamp. After some cudgeling of brains it was suggested to the inquirer that what he probably wanted was a throw-over switch, and this proved to be true. On the same day another person made inquiry about a consecrated lamp. It was thought that this man had become interested in the tungsten lamp by hearing of its superlative qualities, and he was satisfied to accept tungsten lamps as the nearest thing to consecrated lamps that the company had.

* * *

OLD EMPLOYEES OF PHILADELPHIA ELECTRIC COMPANY CELEBRATE.—A banquet was tendered to fifty of the original employees of the Edison electric light station in Philadelphia, now chiefly officials and engineers of the Philadelphia Electric Company, on March 12 at the Continental Hotel. The banquet was given in honor of their twenty-fifth anniversary in the service of the company. Medals struck from the copper of the first switchboard in the old station at 908 Sansom Street were given to each of the fifty veteran employees. These medals were gold-plated. In addition, 300 unplated medals were distributed to 350 of the company's employees who were present. Mr. W. C. L. Eglin, one of the veterans, who is now second vice-president of the company, acted as toastmaster. An address was made by Mr. Joseph B. McCall, president of the company.

* * *

CANTON (OHIO) PARENTS DEMAND ELECTRIC CLEANERS FOR PUBLIC SCHOOLS.—A diphtheria scare in the schools at Canton, Ohio, recently awoke the public to the fact that healthful conditions did not exist in the city school buildings. One of the unsanitary practices uncovered through investigations made by local newspapers and citizens was that of sweeping while pupils were still in the school buildings. This practice, the janitor asserted, was necessary in order that the cleaners might do all work assigned to them. Two school buildings out of a total of eighteen were then equipped with electric suction cleaners of the stationary type. In these schools it was soon discovered that dust and dirt were at a minimum, and an association of parents and teachers was at once formed to force the school board to action in installing further vacuum-cleaner equipment. As the situation now stands the parents' association is demanding that the remaining schools be equipped with vacuum cleaners, but the school board has intrenched itself behind the statement that its funds are insufficient for the purchase of necessary apparatus.

* * *

SOCIETY MEETINGS

NEW ENGLAND SECTION, E. V. A.—At a regular meeting of the New England Section of the Electric Vehicle Association of America scheduled for March 25 at the offices of the Lynn (Mass.) Gas & Electric Company the program included a description by Mr. Sewall Cabot, of the Electric Conversion Company, of a new mechanical rectifier for battery charging.

* * *

NATIONAL DISTRICT HEATING ASSOCIATION.—The annual convention of the National District Heating Association will be held at Rochester, N. Y., May 26, 27 and 28. Among the subjects to be discussed are the operation of bleeder turbines, turbine-driven pumps versus reciprocating pumps, and the relative efficiency of intermittent and continuous heating.

* * *

NEW YORK MEETING, E. V. A.—"The Effect of Power-Wagon Operation on Terminal Freight Congestion" is the title of a paper to be given April 24 by Mr. Fred A. Hortter, car accountant Boston & Maine Railroad, before the Electric Vehicle Association of America at the United Engineering Societies Building, 29 West Thirty-ninth Street, New York City.

* * *

NEW YORK ELECTRICAL SOCIETY.—At a meeting of the New York Electrical Society to be held on March 31 Dr. Frederick G. Keyes, of the Cooper Hewitt Electric Company, will give an outline of high-pressure mercury-arc lamps. Mr. D. McFarlan Moore will describe his latest work, illustrated with lantern slides, and will demonstrate various types of apparatus, including lamps and long tubes supplied with nitrogen and neon and carbon dioxide. The meeting hall will be lighted with a 184-ft. Moore tube lamp.

* * *

PITTSBURGH SECTION IRON AND STEEL ELECTRICAL ENGINEERS.—Seventy-two members and guests were present at the third monthly meeting of the Pittsburgh Section of the Association of Iron and Steel Electrical Engineers, held at the Seventh Avenue Hotel, Pittsburgh, Pa., March 14. Following the usual dinner Mr. H. W. Eastwood, Cleveland, Ohio, gave an illustrated talk on "The Application of Automatic Control to Machine Tools." Messrs. O. R. Jones, W. O. Lumm, W. F. Detwiler, W. C. Kennedy and Paul Caldwell took part in the discussion.

* * *

RADIO ENGINEERS.—A meeting of the Institute of Radio Engineers will be held at Columbia University, New York City, April 1, at 8:15 p. m. Past-president

Marriott will present an original paper entitled "Specifications for Steamship Radio Equipment," relating to the proper and preferred types of main and auxiliary transmitting apparatus. In connection with this subject Mr. Marriott will also discuss the allied subject of emergency lighting of steamship passageways and lifeboats from the same auxiliary source of energy as that which is used for the emergency operation of the radio transmitters.

* * *

REJUVENATION AT ST. PAUL.—About 100 men, including candidates, attended a rejuvenation and joviation of the Jovian Order at the Hotel St. Paul, St. Paul, Minn., on the night of March 18. The meeting was held during the annual convention of the Minnesota Electrical Association, the sessions of which were held in Minneapolis. Statesman B. O. Horton presided, and Mayor Keller of St. Paul, who is a Jovian, acted as toastmaster at the dinner. Among the other speakers were Messrs. Jacob Price, insurance commissioner of the State, representing the Governor; P. T. Glidden, of St. Paul, general manager of the Consumers' Power Company, and J. O. Corbett, of Pittsburgh, statesman-at-large. A class of thirteen candidates was initiated.

* * *

CHICAGO JOVIAN LEAGUE ON A SELF-SUSTAINING BASIS.—At its meeting on March 23 the Chicago Jovian League adopted changes to its constitution and by-laws which provide for annual dues of $2, also for a class of non-Jovian members. The non-Jovian members shall have the privileges of the luncheon club for one year, but no longer, and will not be allowed to vote or to hold office. About 100 Jovians attended the meeting and practically all of them signed the application cards to become paying members of the Chicago Jovian League. After the business matters had been disposed of the meeting was turned over to the electrical contractors, Mr. C. R. Kreider presiding. Mr. Ernest Freeman, president of the National Electrical Contractors' Association, gave a talk explaining the purposes of that association. One of these purposes, he said, is to endeavor to secure the passage of laws in the various States providing for the licensing of electrical contractors.

* * *

DAYTON REJUVENATION.—Under the direction of Mr. Thomas F. Kelly, of the Dayton Power & Light Company, statesman for Ohio, a successful Jovian rejuvenation was held in Dayton on March 21. The number of candidates initiated was 51 and the total number present at the dinner was 115. Mr. Frank M. Tait, president of the Dayton Power & Light Company, was the toastmaster, and Mr. Sam A. Hobson, of Chicago, Western manager of the *Electrical World*, was the guest of honor and first speaker, detailing the history of the order and its purposes and aims. Judge E. P. Matthews, the general attorney of the Dayton Power & Light Company; Mr. W. W. Mumma, of the Robbins & Myers Company, Springfield, statesman for Ohio; Mr. J. E. Barlow, director of public service in Dayton; Mr. Chryst, chief engineer of the Dayton Engineering Laboratories, and Mr. V. G. Apple, president of the Apple Electric Company, were the remaining speakers.

* * *

JOVIANS OF SOUTHERN CALIFORNIA.—The regular weekly luncheon of the Jovian Electrical League of Southern California was held at Christopher's, Los Angeles, March 18, more than 100 members attending. Mr. R. H. Ballard, secretary and associate general manager of the Southern California Edison Company, presented an interesting address on the Los Angeles power situation. After giving a brief review of the passage of bond issues for the completion of power development at the Los Angeles aqueduct, he led up to the proposed new issue which goes before the voters in May "for the completion of power plant No. 1 and the acquisition or construction of a distributing system." This is the same issue that went before the voters in April, 1913, and was defeated. Mr. Ballard defended the position taken by the power companies and clearly showed that their policy in defending their properties was in the interests of the community as well as of the bondholders.

* * *

JOVIANS ADOPT RESOLUTIONS ON DEATH OF WESTINGHOUSE.—At the regular Jovian luncheon held in Pittsburgh on March 19 addresses were made on the life and work of George Westinghouse by Col. H. G. Prout, president of the Union Switch & Signal Company, and by Mr. R. S. Emery, secretary-treasurer of the Westinghouse Air Brake Company. Resolutions were also adopted as follows: "Whereas in the removal from the sphere of earthly activity of George Westinghouse the Jovian Order has lost an honorary member who not only was a benefactor to the human race but to whose unceasing efforts and keen foresight is due much of the wonderful advancement in the electrical industry, and whereas his removal leaves a void in the industrial world and his industrious efforts in the field of engineering stand unique in the world, therefore be it resolved by the Pittsburgh Jovians here assembled, that we feel a personal loss and that the Jovian Order at large has been deeply afflicted in the death of our honored member."

* * *

REJUVENATION AT INDIANAPOLIS.—Under the direction of Mr. Thomas A. Wynne, vice-president of the Indianapolis Light & Heat Company and Indiana statesman for the Jovian Order, a very successful Jovian rejuvenation was held in Indianapolis on March 20. There were 131 candidates initiated, and the number of Jovians who sat down to the dinner was 331. The exercises were held at the Hotel Severin and the well-trained degree team was in charge of Mr. J. H. Payne, alternate statesman. This degree team is preparing to enter the team contest at the Jovian convention to be held in St. Louis next October. Among the candidates admitted to the order were Governor S. M. Ralston of the State of Indiana and Mayor Joseph E. Bell of Indianapolis. Mr. Wynne was the toastmaster at the banquet and Mr. W. N. Matthews, of St. Louis, reigning Jupiter of the order, was the first speaker. He was followed by Mr. Sam A. Hobson, of Chicago, past-Jupiter; Mayor Bell; Mr. John B. Cockrum, attorney for the Indianapolis Light & Heat Company; Governor Ralston, and Mr. Ell C. Bennett, of St. Louis, the Mercury of the order. Governor Ralston spoke of the desirability of recognizing the rights of buyers and consumers, as well as recognizing the mutual rights of sellers and producers. The Jovian Order will live forever, he said, if its members follow the teachings of the ritual. The Governor, and indeed the other speakers, also spoke feelingly of the desire of the Indiana Jovians to elect Mr. Wynne as the next reigning Jupiter on the occasion of the next convention of the order. The chief magistrate said it was the duty of all Jovians in Indiana to increase the membership of the order in that State, and therefore to go down to the St. Louis convention with a strong claim to the Jupitership. Mr. C. C. Perry, president of the Indianapolis Light & Heat Company, was chairman of the reception committee. On the morning of March 20 the *Indianapolis Star* signalized the rejuvenation by bringing out a four-page Jovian section with portraits of well-known Jovians.

Steam and Hydroelectric Generating System

Water-power plants of the Lewiston-Clarkston Improvement Company developing irrigation flow near Clarkston, Wash., and subsequent installation of steam-turbine auxiliary stations

THE Lewiston-Clarkston Improvement Company was originally formed for the double purpose of building a dam and flume to supply water for irrigating a considerable section of fine agricultural land about Clarkston, Wash., and of selling these lands, with water rights,to settlers and others interested in the raising of high-class fruits and farm products. However, the advantages of combining this irrigation undertaking with the installation of water-power stations for furnishing electrical energy for light and industrial service in the vicinity soon became apparent. Two hydroelectric plants were therefore made a part of the initial installation and shortly afterward electrical service was inaugurated at Lewiston, Idaho, and Clarkston, Wash.

During the year 1910, however, on account of extensive sales of land, the company found itself handicapped by the lack of water to operate its hydroelectric stations and it became apparent that additional generating equipment of some kind would have to be installed to relieve the situation. The purpose of this article is therefore to outline the problem which confronted the managers of the properties and to show how the difficulty was successfully met and why an additional steam station was finally installed.

The Asotin Creek Installation

On the Clarkston side of the Snake River, a number of years ago, an irrigating scheme was placed in operation and grapes were raised extensively. The possibilities of the country were even then apparent, so that the improvement company built a dam on Asotin Creek and conveyed water from this source through an open flume 13 miles to Clarkston. The original purpose of the installation was to secure water for irrigation purposes, but about this same time the city of Lewiston had developed to such a point that it was deemed advisable to install generating equipment to furnish electric service for the two cities of Lewiston and Clarkston as well as for some of the adjacent towns.

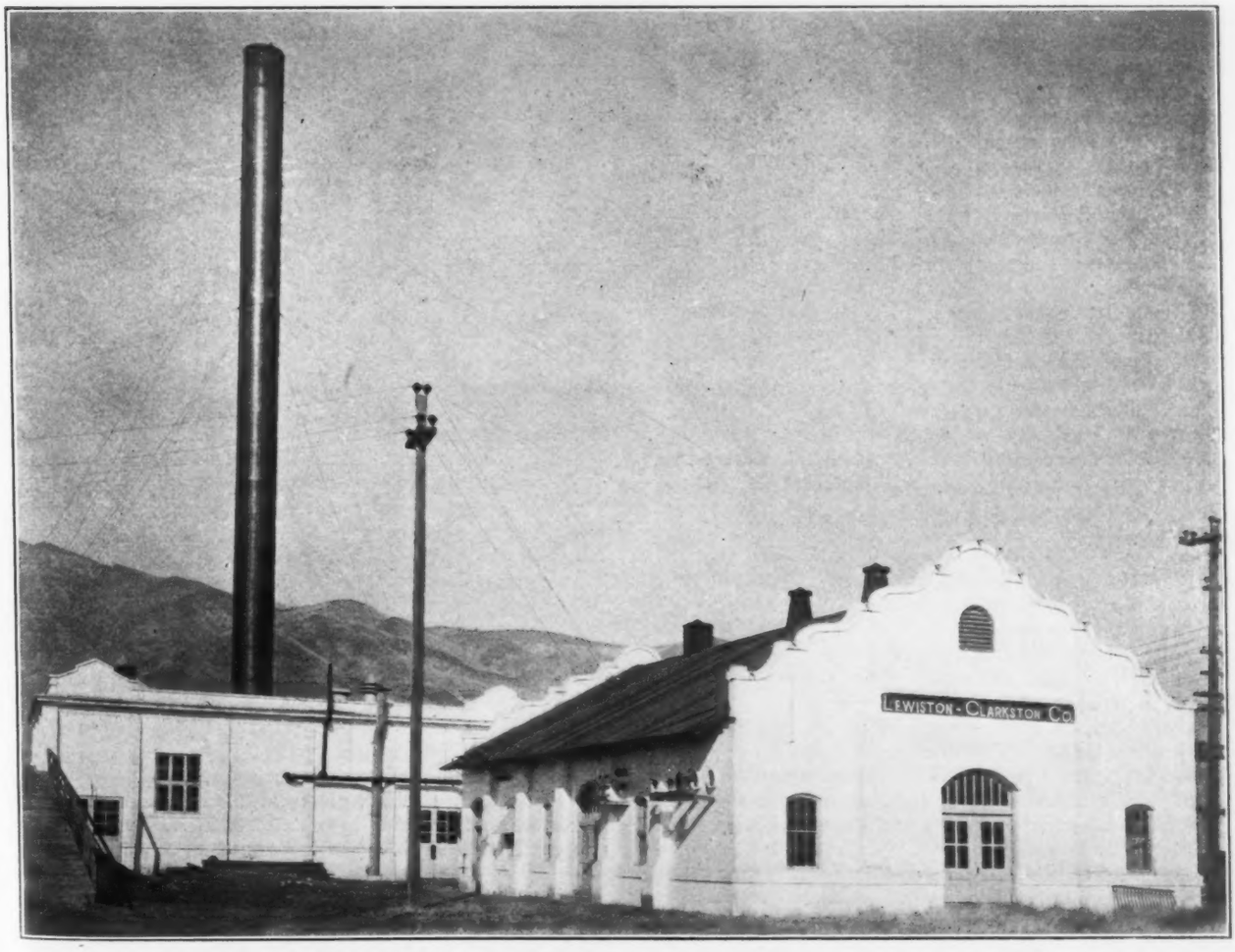


FIG. 1—STEAM PLANTS OF THE LEWISTON-CLARKSTON IMPROVEMENT COMPANY, CLARKSTON, WASH.

On Asotin Creek, a few miles above the town of Asotin, a 400-kw impulse-type waterwheel and generator were therefore installed. This wheel took water from the irrigation flume and discharged into Asotin Creek. Its operating head was about 450 ft. The flume soon proved to be insubstantial and leaked so badly that the company was compelled to tear it out and replace it with a wood-stave pipe line. This line is 48 in. in diameter as far as the Asotin Creek plant and 36 in. in diameter from there on to the Pomeroy station.

The Present Hydroelectric Development

The hydroelectric development of the company thus at present consists of two plants. The station on Asotin Creek contains two Doble impulse turbines, each direct-connected to a 750-kw, three-phase, 2200-volt, sixty-cycle, 300-r.p.m. Westinghouse generator. The wheels are designed to operate under a head of about 518 ft., although the static head on the plant is about 543 ft. Each wheel is controlled by a Lombard governor. The two 40-kw exciters are belted to the main wheels. Water is taken from the irrigation line through a steel pipe running almost directly down the side of a very steep hill.

At the Pomeroy plant situated at the lower end of the pipe line there is installed a three-runner Pelton impulse turbine with one nozzle and one needle nozzle per runner. The turbine is directly connected to a 2200-volt, three-phase, sixty-cycle generator of Westinghouse make, which has a rating of 400 kw.

The dam and irrigation line had been installed to take care of practically all of the flow in Asotin Creek, so that it was impossible to secure additional water from this source when it became apparent that the supply was running low.

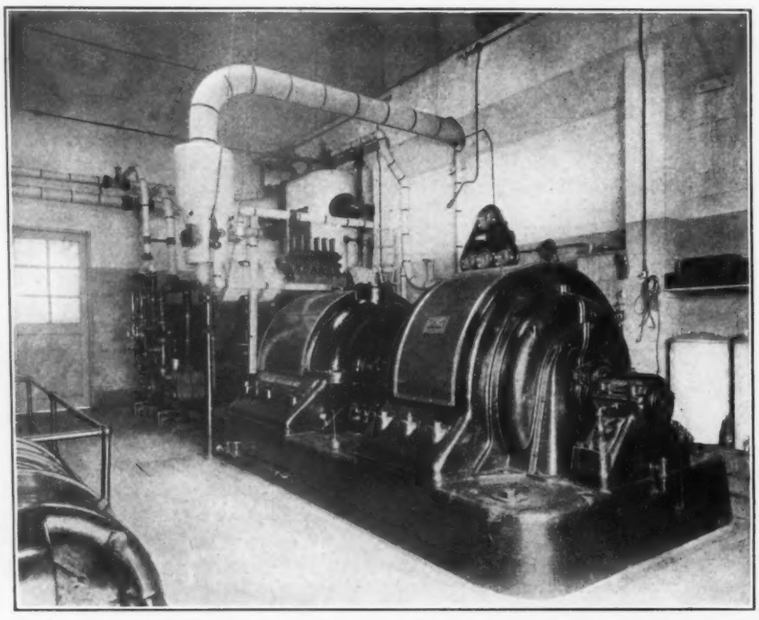


FIG. 2—MAIN TURBINE, AND FEED-WATER PUMPS AND HEATER

The First Auxiliary Steam Plant

A steam plant was therefore built in Clarkston on the bank of the Snake River. This auxiliary plant, of 400-kw rating, contains three 72-in. by 18-ft. high-pressure return-tubular boilers and one of the first Westinghouse-Parsons steam turbines installed in this vicinity. The condensing equipment consists of a surface condenser, with rotative dry vacuum pump, and an engine-driven circulating pump. There is a 6-ft. engine-driven induced-draft fan, controlled by a steam-pressure regulator. This fan discharges through a 48-in. steel stack which extends for about 50 ft. above the boiler-room floor.

Considerable difficulty was experienced in operating this first steam plant for several reasons. There is, for example, a very great difference in elevation between the low and high water stages of the Snake River. This stream has a very long course through the State of Idaho and flows through a country sparsely covered by vegetation, so that the run-off is very rapid. During the period of high water the stream carries large quantities of suspended matter. It flows very swiftly and the suspended matter does not have an opportunity to settle. Stones, leaves, sticks and fine earth were during these periods drawn into the condenser in such great quantities that the plant could not operate for more than a few hours without shutting down. The suspended matter also entered the boilers, rendering the plant inoperative by the accumulation of mud in the feed and steam pipes. During the period of very low water the circulating pump could not raise the water from the river, and it was necessary to install a motor-driven centrifugal pump to discharge the water into the circulating pump.

Conditions Affecting New Extensions

In the summer of 1910 new interests acquired the Clarkston property and in an energetic manner started in to improve the conditions then existing. At this time the peak load on the system was between 1500 hp and 1800 hp. About half of this power was used in and about Lewiston, and the rest was sent out over a transmission line to Moscow, Pullman and the intermediate towns. The Asotin Creek plant could carry during the summer time about 400 kw from midnight to 4 a. m., and during the rest of the day about 200 kw. The remainder of the water had to be used for irrigation purposes. The Pomeroy plant carried about 175 kw continuously, there being required at the lower levels sufficient water for irrigation to use up the discharge from the wheel when operating at this load. The rest of the load had to be carried with the steam plant.

There were several possible methods of increasing the generating capacity of the system. The first to be considered was the replacing of the turbine on the end of the pipe line at the Pomeroy plant with a larger waterwheel, in order that more power could be secured from the water discharged through it.

Another method of augmenting the generating equipment would have been to add units to the existing steam plant. The matter was gone into very thoroughly and carefully, but after investigation it was believed that this would be inadvisable.

As a third possibility, the company had available on the Grand Round River, about 25 miles from Clarkston, a hydroelectric power site capable of developing approximately 10,000 hp, which would have been sufficient to meet its requirements for some time to come. This development seemed to be a good and feasible one to undertake, provided there could be secured a market for the power of the complete development, but in view of the facts that such a market was not available and

that a partial development would entail a very heavy expenditure per unit of capacity, this scheme was also reported on adversely.

Plans for a New Oil-Burning Steam Plant

It was therefore finally decided to install an altogether new steam plant, as this seemed to offer the most satisfactory way of meeting the situation. Such a steam plant could be installed promptly and at a lower cost per kilowatt of rating than a new hydroelectric development, and for the existing conditions the cost of power production would be less with the steam plant. The cost of coal at the plant site was $6.75 per ton, but nevertheless the above conclusions were reached after a very careful analysis of the situation and have since been confirmed by the very satisfactory results secured.

A spot was therefore selected alongside the existing Clarkston steam station on the bank of the Snake River, and designs and tenders for a 1560-kw steam station were asked. Charles C. Moore & Company, engineers, Seattle, Wash., were the successful bidders, and contracted to install the plant complete, the General Electric Company furnishing the turbine set and its auxiliaries.

At the time the contract was awarded negotiations were being made with the railway company in an endeavor to have the freight rate on fuel oil from the Pacific Coast lowered sufficiently so that oil would be the most economical fuel to use in the plant. The plant contract was awarded, therefore, on the basis of an oil-burning station. There is no railroad on the Clarkston side of the Snake River, and it was intended to install a small pumping station on the Lewiston side of the stream and to run a pipe line 1700 ft. long across the bridge and over to storage tanks alongside of the power plant. Oil was to be taken directly from tank cars on the siding and pumped into the storage tanks.

As it frequently becomes very cold at Clarkston during the winter, special arrangements were considered to facilitate the handling of oil through the pipe line

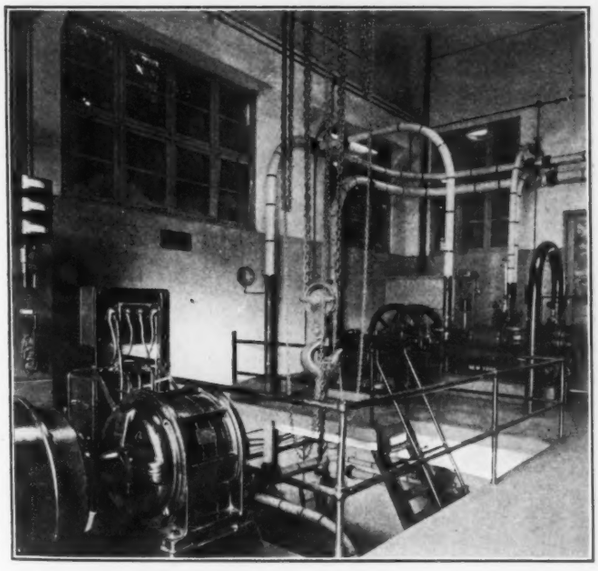


FIG. 3—CONDENSER PIT, AIR PUMP AND EXCITERS

at low outdoor temperatures. Provision was made for the installation of a pumping plant to contain a small vertical boiler and duplex pumps, with an oil heater of sufficient size to raise the temperature of the oil to a point permitting its ready discharge through the pipe line. In order that the pipe might be cleaned out after a cargo of oil had been unloaded, it was intended to pump water through the pipe line, floating the oil up to the crown of the bridge, the highest point on the system, and, discharging the oil and water, leave the pipe empty. This would have very much facilitated the discharge of the oil through the pipe when again starting up.

The installation as originally proposed was to contain

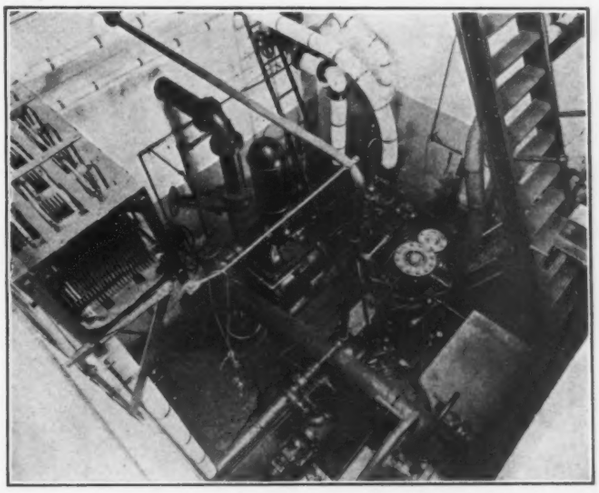


FIG. 4—VIEW LOOKING DOWN INTO CONDENSER PIT, SHOWING CIRCULATING AND FIRE PUMPS

one 1560-kva Curtis steam-turbine set, one turbine-driven exciter, one motor-driven exciter, two Stirling 321-hp water-tube boilers with Peabody patented fuel-oil furnaces, arranged with special grates for burning bituminous coal; one Wheeler "dry-tube" surface condenser, etc. In addition to a 2000-barrel oil-storage tank, two auxiliary measuring oil tanks were to be provided. These were to be placed alongside the plant and to be filled from the main storage tank by gravity. The small tanks were expected to furnish a means of measuring the quantity of oil used daily by the plant, as one tank could be filling while oil was being used from the other.

Shortly after the contract for the plant had been let it was found that the freight rates on oil could not be sufficiently reduced to make the use of this fuel permissible, so a modification of the design was made, all of the oil-handling equipment being omitted and the boilers being arranged to be fired with coal. Next there arose the question of the use of stokers. The plant had been so designed that one operator could handle everything in the turbine room, and the boilers could be fired by two men hand-firing or by one man with automatic stokers. The interest on the additional investment for mechanical stokers would be offset by the saving of one fireman's wages and by the saving in fuel. However, on account of the first cost of the stoker equipment, it was finally decided to use hand-fired furnaces with shaking grates.

Features of the Present Installation

The plant was, of course, so designed that it could be readily extended in a down-stream direction. The wall on this side of the building was made of metal lath and plaster so that it could be easily removed. Building columns were designed for an extension and the crane supports and beams were designed so as readily to permit of extensions, reinforcing bars being left where they could facilitate tying in with an addition. The building is of reinforced concrete of simple but substantial design. The soil where the plant stands is hard-pan, sand and gravel. The plant building meas-

ures 65 ft. in length by 39 ft. in width, with a 23-ft. ceiling.

The rise and fall of the Snake River at the plant site is more than 30 ft., so that in order that the circulating pump could be within suction limit of the water at the low stage it was necessary to design a deep condenser pit. The circulating pump is installed in a well

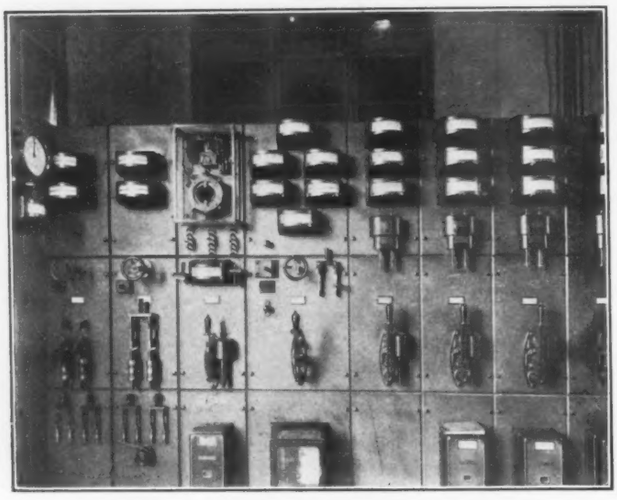


FIG. 5—PLANT SWITCHBOARD

18 in. below the turbine-room floor, which is but a little above the maximum high-water stage. The pit for the condenser itself did not have to be so deep, but in the pump pit there are, besides the circulating pump and engine, a large fire pump rated at 1000 gal. per minute and the hot-well pump. One of the problems involved was the design of this pump pit so that it would neither leak nor float. The floor was made very heavy and reinforced, and the walls were then built on this platform, the joint being made at an angle so that the pressure inward in all directions tended to close the joints and also helped prevent any tendency to caving in.

From the circulating-pump pit a cast-iron bell and spigot-pipe line extends out to the river. Where the pipe went through the wall special rings were cast on the pipe, which, being embedded in the cement, formed a joint that has given no trouble from leakage. Considerable difficulty was, however, experienced in anchoring the suction and circulating pipes. The discharge pipe is run along just under the ground and the end of the pipe is carried down to and sealed below the water, so that the circulating system is on a closed siphon, reducing the work of the circulating pump and engine. The circulating pump is primed with a steam primer. A sump pump removes all drainage and leakage.

One condition in connection with the surface condenser installation appeared to offer a possible source of trouble, and this was the probability of the condenser tubes and tube sheets becoming fouled with débris. To overcome this difficulty a very simple and ingenious arrangement of circulating piping connections was made, so that by operating four valves it is possible to reverse the flow of water through the two-pass condenser. Sometimes the direction of flow had to be thus reversed every hour in order to wash out the accumulation, but immediately after reversing the flow, which takes but a few seconds, the vacuum comes back to normal.

From one of the illustrations shown it will be noted that the feed-water heater, which is of the open type, is mounted on a platform above the turbine-room floor. The boiler-feed pumps are installed directly underneath and are controlled by pressure governors. This arrangement places everything excepting the boilers in the turbine room, out of the way of dust and dirt and under the eye of the engineer at all times.

General Piping Layout for Plant

The piping in the plant was laid out with the idea of having all connections as short as possible. Bends were used in lieu of fittings wherever their installation was permissible. This was done not only to decrease the number of connections and the friction of the steam but also to allow for expansion and contraction. The main steam-pipe sizes employed are relatively small compared with standard practice for a plant of this size, the idea having been, however, to decrease the loss in the plant by pipe radiation. There is some pressure drop between the boilers and the turbine, amounting to almost 8 lb. at full load, but this does not interfere with the operation of the plant, and it is probable that the over-all plant economy has been best served by this design.

The reader has doubtless noted that the boiler rating of the plant is relatively small for an installation of this kind. This size of equipment was chosen, however, for the reason that the plant at certain seasons of the year is either not in use at all or carries but a very small percentage of its rated capacity, owing to the fact that sufficient water is available for operating the hydroelectric stations when irrigation is not being carried on. The smaller boiler installation, of course, cost less than a larger number of units, resulting therefore in a considerable saving in the total first cost of the plant. In addition the boilers are of Stirling design and are capable of carrying heavy overloads without injury. In order that the boilers might carry overloads a large stack was installed 125 ft. above the boiler-room floor. This stack gives ample draft so that, together with the arches which are installed in the furnaces and over the grates, a large amount of coal can be burned per square foot of grate surface, and the boilers have without difficulty been able to operate the plant at a considerable overload on the generating equipment.

Test observations were recently made on the plant

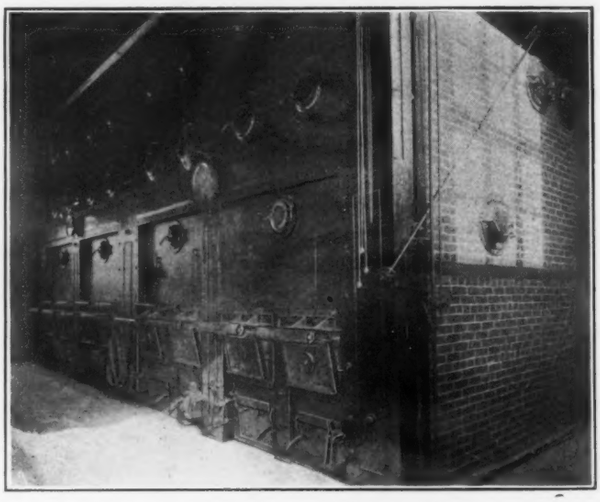


FIG. 6—BOILER ROOM, SHOWING 642-HP UNITS

covering a period of two days, during which all of the coal was weighed. Under ordinary operating conditions it was found that the plant will develop a kilowatt-hour on about 3.5 lb. of combustible or 45 lb. of coal. At the time of the test Roslyn nut coal was being fired. During the period of this run the load-factor averaged about 45 per cent.

Electric Arc Welding

Utilization of carbon arc and metallic arc to bring metals to be welded to melting temperature—Methods of welding and their application. By Otis Allen Kenyon

IN general two kinds of arcs are used for welding purposes, namely, the carbon arc and the metallic arc. In each case the heat of the arc is utilized to bring the metals to be welded to the melting temperature, when the joint is filled with molten metal, usually introduced in the form of a rod or pencil.

As is well known, the positive side of the direct-current arc generates heat at a rate approximately three times as great as that at which heat is generated at the negative side. Therefore, it makes a considerable difference to which side of the circuit the material to be welded is connected. As a general rule, on account of the comparatively large mass and heat conductance of the material, it is connected to the positive side.

Carbon Arc

The carbon arc generates heat energy at a higher rate than the metallic arc and is therefore best adapted to use in places where comparatively large masses of metal are to be heated, such as in the cutting of iron and steel and the filling of blowholes in castings, as well as in making some kinds of welds where temperature stresses do not play an important part.

In working with the carbon arc the operator holds the carbon electrode in one hand and a melt bar in the other, the arc supplying the heat by means of which the melt bar is worked into the space between the metals to be joined. The carbon arc requires an emf varying between 50 volts and 100 volts, and the value of the current is varied over a range between 150 amp and 700 amp, according to the nature of the work to be performed. Very high values of the current are not as frequently used now as formerly, 300 amp usually being sufficient for welding and cutting work.

With the carbon arc both hands are occupied with the welding, and a mask must be worn to protect the head and face from the powerful heat and ultra-violet rays of the arc. This mask is somewhat of a disadvantage, as the operators find it is disagreeable to wear and also because it interferes with easy inspection of the work.

The carbon arc, employing a comparatively high voltage, varies in length from 1 in. up to 6 in. and therefore it spreads over the surface somewhat as does the oxy-acetylene flame. On account of this action the heat is applied to a surface considerably larger than it is desired to raise to the melting point for welding. For this reason the total amount of heat required to melt the surfaces to be joined is greater than would otherwise be the case, and hence the temperature stresses set up in the metal to be welded are correspondingly great.

In planning the method of welding in any given instance it is of the greatest importance to take into careful consideration the possible temperature stresses and so to lay out the work as to reduce them to a minimum, otherwise the entire mass of the parts to be joined must be preheated.

FIG. 1—WELDING 15-IN., 55-LB. CHANNELS IN RONDOUT SIPHON OF CATSKILL AQUEDUCT

The carbon arc is much better adapted to cutting metals than is the metallic arc. However, the oxy-acetylene flame with the oxygen jet is very much better than the electric arc wherever the metal to be cut is steel because the oxy-acetylene process by means of the oxygen jet burns up the metal and hard steels lend themselves best to rapid oxidation. When cast iron is to be cut the oxidation method cannot be applied and the carbon arc gives the best results, as it permits the application of enormous quantities of heat necessary to melt the metal. Cuts made with the arc are always more or less ragged and must be so arranged that the freshly molten metal can run clear of the cut before hardening.

The Metallic Arc

In the metallic arc process the welding electrode or pencil is incorporated with the melt bar itself, and as this pencil is consumed in the arc the greater part of it passes over and is deposited in the joint to be welded. This process has two distinct advantages over the carbon method: First, by eliminating the carbon the possibility of carbonization of the weld is removed, and, second, by incorporating the melt bar with the welding electrode only one hand is required for welding, and therefore the operator can hold a mask or screen in the other hand while welding and lower it

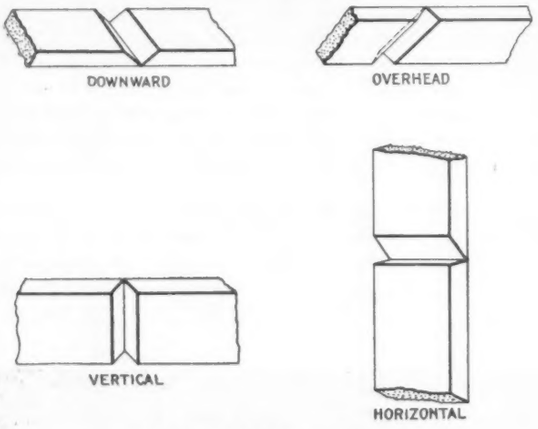


FIG. 2—WELDING POSITIONS

each time the arc is broken; thus the operator can inspect his work with the naked eye at frequent intervals.

The metallic arc requires only a very low emf, namely, from 15 volts to 30 volts. The length of the arc is very short, usually being less than $\frac{1}{8}$ in. The voltage seems not to vary greatly with the length of the arc, because the arc vapor is a very good conductor, practically all the voltage being consumed at the surfaces of the electrodes.

The ability to use an extremely short arc is simultaneously an advantage and a disadvantage of this process. The disadvantage is that more skill is required to work with a short arc than with a long one as the long arc is more stable. The advantage lies in the extreme localization of the heat, which is of transcending importance. The extreme localization of the heat generated by the short arc permits the melting of metal immediately under the end of the welding pencil, the particles of molten metal traveling from the pencil through the arc and combining with the molten metal at the point opposite the end of the electrode.

In this arc it is not necessary to give the electrode a rotary motion. On the contrary, it is held perfectly quiet for an instant and then moved ahead one step, the metal being deposited in a series of drops which are run together as a string.

Temperature stresses with a properly manipulated metallic arc are practically negligible, and wherever they are liable to occur they can be taken care of without resorting to preheating or any complicated method of procedure except in massive and complicated castings in which large quantities of metal are deposited within a small radius. In the metallic arc process practically all the heat is utilized for welding, very little being dissipated uselessly in the mass of the metal.

Energy Supply

The welding-arc circuit should preferably have a constant-current characteristic so as to produce stability in the arc. Where only one arc is used a constant-current generator may be used. In other cases the constant-current characteristic can be obtained by connecting a rheostat in series with the arc across a constant-potential system. The series resistance gives greater voltage across the arc when the current tends to decrease and less voltage across the arc when the current tends to increase. In this way the voltage across the arc varies with the length of the arc and the current is kept approximately at a constant value. Naturally the resistance method of stabilizing the arc is extremely wasteful, according to usual practice from 40 to 60 and more volts being consumed in the rheostat as compared with about 20 volts in the welding arc. The carbon arc may be operated without a series rheostat, but means must be provided for protecting the generator from dead short-circuit when the arc is struck.

When using constant-potential machines the only limit to the number of arcs that can be connected in parallel is the current-carrying capacity of the machine. For metallic arcs with series rheostats it is usual to estimate 150 amp for each arc, the arc itself consuming 25 volts. The current for carbon arcs is usually estimated at 300 amp and the emf at 70 volts. Welding generators wound for low voltages are now manufactured by several different firms.

Operation

The joint to be welded is prepared by cutting away the edges in such a manner as to allow the insertion of the electrode or welding pencil into the innermost part of the joint for drawing an arc at that point.

The angle of bevel depends on a number of factors: the kind of metal to be joined, the composition of the joint, the direction in which the welding is to be done, and the strength required. For very high-strength joints it is desirable to have a comparatively large area of contact between the deposited metal and the original metal.

There are several different positions in which welds can be executed, namely, downward, vertically, horizontally and overhead. These various positions are shown in Fig. 2.

In downward welding full advantage can be taken of gravity. Horizontal welds can sometimes be arranged so as to be almost as easily executed as downward welds. Vertical welds require about 25 per cent longer time than downward welds, and overhead welds require about 67 per cent longer time.

Overhead welding is not practicable with the carbon arc. However, it is easily performed with the metallic arc provided that the welding electrode is coated with a refractory flux. This flux coating, which was invented by Kjellberg in Sweden, performs two functions: It supplies flux to the welds at the rate which bears a definite relation to the rate of consumption of the welding pencil, and it forms a tiny crucible which holds a small quantity of molten metal on the end of the electrode upon which the "pinch effect" of the current may act. In this way the molten metal on the end of the pencil is squeezed outward and upward onto the joint,

where it sticks. Without the coating on the electrode the metal does not travel against the force of gravity but falls in a stream onto the floor.

Fig. 3 shows the time in minutes required to weld steel plates of different thicknesses and by different methods of cutting the joints. In these curves no allowance has been made for time required to change welding pencils or prepare the work. They cover simply the actual time of welding. Ten seconds is sufficient time to allow for changing a welding pencil by properly trained men.

The success of an arc weld is determined by a number of factors, as follows: First, the work must be planned by some one who understands both the welding and operating conditions to be met by the apparatus that is to be repaired. Second, the composition of the welding pencil and the flux used with the pencil must be chosen with due respect to the metal to be welded. Third, the value of the current must be determined

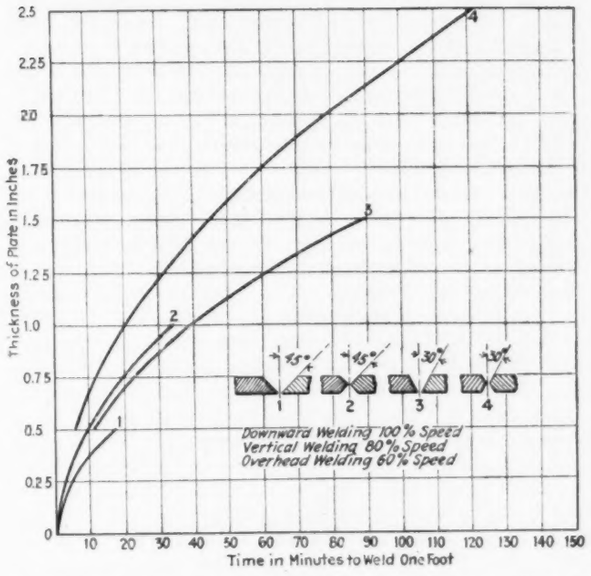

Thickness of Plate in Inches
Time in Minutes to Weld One Foot
Downward Welding 100% Speed
Vertical Welding 80% Speed
Overhead Welding 60% Speed

FIG. 3—RELATION OF THICKNESS OF PLATE TO TIME OF WELDING

with reference to the metal to be welded as well as the liability to temperature disturbances.

Applications

Arc welding is one of the oldest practical applications of electrical energy, and yet only in recent years, comparatively, has it come into very extensive use. The slowness of the development of a process which offers such great possibilities is attributable entirely to a failure to consider the necessity for an enormous amount of special knowledge. Arc welding was originally supposed to be extremely simple, and this supposition resulted in many failures which greatly retarded its development.

The beginning of the present activity in arc welding dates back to only a few years ago when the metallic arc with the coated electrode was first taken up in Europe. This process greatly simplified the matter of temperature stresses as well as the control of energy and therefore met with more general success than any method previously known. At the present time it is recognized that successful arc welding can be accomplished only by skilled operators under the direction of competent superintendents. There is no longer a question as to the possibility of producing strong welds; in fact, the welds are just as strong as the original material. Nevertheless, most engineers are ready to use arc welded joints only in places where tests can be applied after the work has been finished.

In boilers, pipe lines, tanks, etc., where working pressure can be applied with little trouble, arc welding has been successfully introduced. It is also very generally used for reclaiming defective and broken castings, for filling holes and building on projections.

Lack of experience has led engineers to regard arc welding suspiciously wherever important work that cannot be tested in place is involved. At present only those trained in the art of welding are competent to pass upon the quality of a joint, and hence unless some method is devised whereby an ordinary mechanic can ascertain the quality of a welded joint by simple inspection the art of electric welding will suffer from the lack of knowledge and experience in its use by those who have to pass upon and determine the design of structures.

Notable Application

Probably the most noteworthy application of electric arc welding was that of the steel lining of the Rondout siphon of the Catskill Aqueduct, executed by The Electric Welding Company. In this instance the metallic arc process was applied to butt-weld 15-in., 55-lb. channels into the form of rings, which were then riveted together and protected from corrosion by concrete placed outside and inside. The total head of water acting upon this tunnel, which is 14 ft. 2 in. inside diameter, may be as high as 750 ft., although the external ground-water pressure will compensate for a good deal of internal pressure.

In sanctioning this application of electric welding the Board of Water Supply of the city of New York very carefully investigated the process by welding full-size specimens and subjecting them to tests. In October, 1913, the water was let into the tunnel and the job accepted as perfect.

Irrigation Pumping Losses Due to Pipe Friction

The head under which a given pump is to operate may be materially increased by installing suction and delivery pipes of too small diameter and by putting into the pipe line unnecessary bends or by having those that are necessary so abrupt as to impede the flow of water, said Mr. James E. Davidson, general manager of the Pacific Power & Light Company, Portland, Ore., in a recent paper on the subject of "Electrically Operated Pumping Plants."

Williams and Hazen's tables show that a 6-in. cast-iron pipe delivering 410 gal. of water per minute will have a friction head of approximately 2.4 ft. per 100 ft. of pipe. A 4-in. pipe, under similar conditions, would have a friction head of approximately 17 ft. per 100 ft. of pipe used, while a 3-in. pipe would have a friction head of about 68 ft. per 100 ft. of pipe. It can be readily seen that the friction head caused by small pipes is excessive and the use of such pipes must be avoided. They will cause high bills.

As an example, consider the power required to force 410 gal. of water per minute against the friction of 100 ft. of 4-in. and of 6-in. pipe. The 4-in. pipe would require 3.36 hp to overcome the friction head, whereas the 6-in. pipe would require but 0.47 hp to overcome the friction head, or a difference of 2.89 hp in favor of every 100 ft. of the 6-in. pipe. If it is assumed that a certain plant was pumping 410 gal. a minute through 100 ft. of 6-in. pipe, and instead of the 6-in. pipe a 4-in. pipe was substituted, the irrigator would be required to increase his power from 10 hp to 12.87 hp, or nearly one-third.

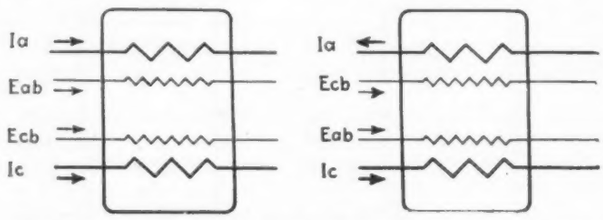
Economies of Power-Factor Adjustment

Methods of securing best power-factor conditions for both energy-supply companies and energy users—Bonus system for keeping the power-factor high. By H. B. Dwight

THE importance of power-factor in alternating-current systems is very generally realized, but the methods for securing economically the best possible power-factor conditions are not always clearly understood. Synchronous motors have long been used for the sake of their effect on the power-factor. Contrary to the rather usual practice, however, the adjustment of synchronous machinery should not be determined by any single rule, much less let go by default, but the adjustment should be made according to a careful study of the local conditions. It is the object of this article to point out principles governing the adjustment of power-factor for the best interests of the customers and of the energy supply company for all cases involving the sale of energy, including that of small central stations as well as that of large transmission systems.

The early central stations supplied energy to loads composed almost entirely of incandescent lamps, of practically 100 per cent power-factor. When induction motors came into general use the power-factor of the station loads became lower, and several distinct disadvantages were felt from this cause.

First, when the alternators were delivering their full rated output in volts and amperes, the true power in kilowatts delivered, on which the income was based, was



FIGS. 1 AND 2—ENERGY MEASUREMENT AND REACTIVE ENERGY MEASUREMENT

low. The steam engines or other prime movers could not be loaded up to their full capacity without overloading the generators. The exciters were also called upon to deliver more power in order to hold up normal voltage on the alternators, owing to the demagnetizing effect of the lagging low power-factor current. The disproportion between the prime movers and the electrical machinery has been corrected in more recent installations, but the fact still remains that an 80 per cent power-factor load means a current 25 per cent greater than the same real load at unity power-factor, and accordingly there is a 25 per cent increase in cost of all the electrical apparatus, including generators, exciters, transformers, transmission lines and distribution lines.

Another disadvantage is felt in addition to the above and really distinct from it. Even for the same value of current, a low power-factor load produces a much greater voltage drop in an alternating-current line than a high power-factor load, owing to the voltage from the lagging reactive current and the reactance of the line. This is not a disadvantage so long as the energy is being sent only a relatively very short distance, because the power transmitted by the conductors is limited by their heating, and the voltage drop is not noticed. But in practically all instances the distance to which electric energy is sent is great enough to make the voltage drop very troublesome, since it produces variations in the voltage, and accordingly the limit of output of most alternating-current lines is not in their heating but in their voltage drop or regulation.

Thus low power-factor increases the cost of the lines even more than it increases the cost of the generators. In city systems the cost of lines is considerable, being proportionate to that of the generators. In long-distance transmission systems the cost of the lines is much greater than that of the generators, and this second disadvantage of low power-factor, in producing very poor line regulation and necessitating extra line construction, is of correspondingly greater importance.

The three usual forms of motor-service contracts and their effect in ameliorating the disadvantages of low power-factor will be described. These forms, while still of universal occurrence, were all planned for lighting and induction motor loads and are more suitable for them than for loads partly made up of synchronous motors.

As a first example, consider the very usual case of a customer who purchases service simply on a kilowatt-hour rate. Supposing that he is under no contract obligation to maintain a high power-factor of his load, he feels little, if any, disadvantage from the low power-factor caused by his connecting up a large number of lightly loaded induction motors. If he requires a supply of direct current, he will not be likely to install a synchronous motor-generator set, since it is rather expensive, but he will probably purchase the cheapest and most reliable piece of apparatus, such as a synchronous converter or an induction-motor-generator set.

While low power-factor does not cause any inconvenience to the above-mentioned customer, it is a great source of inconvenience and expense to the energy-supply company, as has been described in the opening paragraphs of this paper. It is a common practice, and a very reasonable one, for the supply company to offer its customers a bonus for keeping their loads at a high power-factor, and we may take as a second example the case of the above customer when a discount is given in the bill if the power-factor is always above 85 per cent, as shown by a graphic meter. It is probable that the power-factor can be kept above this figure by taking pains to choose the induction motors so that they operate at approximately full load. If a number of direct-current motors are used, the direct current can be supplied most economically by a synchronous converter. The converter will operate at approximately 100 per cent power-factor, and while it will give only a small amount of power-factor correction to the entire load, it will probably give as much as is sufficient for a customer with a contract such as that described above. It may be mentioned that synchronous converters are being used to an increasing extent, largely owing to the better operation secured in recent designs by commutating poles and to the high efficiency and low first cost

characteristic of this type of apparatus. Synchronous converters are best operated with a fixed rheostat setting and are not suitable for power-factor control.

The third case is very similar to the second and is that of a customer who buys energy under a contract which gives a bonus for high power-factor, increasing until 100 per cent is reached. This bonus may be given according to the minimum readings of a graphic power-factor meter or it may be given by charging for the total kva-hours instead of the kw-hours. The total kva-hours, however, are very difficult to meter with even commercial accuracy, and it is easier and in other ways preferable to meter the reactive kva-hours, by a special method described later, and to charge for them and the kw-hours separately. The above form of contract, giving a bonus for the very highest power-factor, is used in practice, and the difference in its wording induces a customer to install synchronous motors wherever possible, since they are the only kind of apparatus which can raise the power-factor of an induction motor load up to a value approaching 100 per cent. In such a case, if direct current is required, a synchronous motor-generator set will be preferable to a synchronous converter owing to its greater ability to raise the power-factor. It may also prove economical to specify certain of the larger, steadily running motors to be of the synchronous type, and to run them with over-excited fields for power-factor correction.

Consider now the adjustment of the power-factor by the same company which generates and transmits the energy. The real benefits to the entire system must be estimated, thus making an entirely different problem from that considered above. The best rules for the adjustment of power-factor in any case will be discussed, and the contract terms will be described which will tend to enforce these rules.

It is a fact often overlooked that by attempting to hold the power-factor of a customer's load at any fixed value, as is done by the above-mentioned usual contract clauses, a large part of the benefit obtainable from synchronous motors is lost. It is often better, where there are synchronous motors, to pay less attention to the load power-factor and more to the amount of reactive power which would be desirable. Thus, for example, a synchronous motor in a factory which closes at 6 p. m. would be of considerable benefit to the power system if it were run for an hour or two longer, regardless of the local power-factor. Then, again, a customer of a transmission company may be forced by a contract which penalizes low power-factor indiscriminately to operate his synchronous motors "leading" during the night, even though he is at the same time suffering from an excess of voltage which is detrimental to his lamps, and even though the transmission company is running synchronous machines "lagging" in order to bring the voltage down to the normal value. In this way a wrong form of contract has resulted in actual instances of the synchronous motors of a customer being operated at night in direct opposition to those of the transmission company.

Where a customer's load is at a relatively short distance from the generating station the cost of feeders is negligible, and appreciable voltage variation due to line drop does not occur. Here the only disadvantage of low power-factor is that it increases the load on the electrical apparatus in the station. In any ordinary case there will not be enough synchronous motors to make the power-factor of the entire load leading, and therefore motors close to the station should be run with maximum field current throughout both night and day.

If the energy-supply company is the owner of the synchronous motors, it will make the field current as strong as the heating will allow, and no more attention will be necessary. If a customer owns the motors, the usual penalty for low power-factor will not induce him to operate at a low "leading" power-factor at times of light load. Two forms of contract may be used which will make it profitable for him to operate the motors "leading" all the time. First, as an approximate method, the kilovolt-ampere rating of motors not needed for mechanical load and hence available for power-factor correction may be estimated, and a bonus allowed of so much per kilovolt-ampere. A graphic ammeter can be used to show that the motors carry full kilovolt-ampere load all the time. This method, however, takes no account of a possible low power-factor of the rest of the same customer's load. The second method is more accurate. It consists in using a special, simple connection of a standard polyphase watt-hour meter to measure the reactive energy, and in this way the total leading kva-hours delivered by the customer to the supply system can be metered. This measurement has been made use of in an actual installation, in order to determine the amount of penalties for low power-factor according to a contract provision, by Mr. C. W. Baker, of Hamilton, Canada, and it was described by him in the *Proceedings* of the Canadian Electrical Association, June, 1912. Except for slight errors with an unbalanced load, it is as accurate as an ordinary kw-hour measurement, and it is far superior in accuracy and simplicity to the measurement of the total kva-hours. By means of this measurement the customer can be paid for net "leading" reactive kva-hours, or charged for "lagging" kva-hours, at a rate of, say, one-fourth of the kw-hour rate.

The connection of a standard three-phase watt-hour meter to measure the reactive energy, as shown in Fig. 2, is readily compared with Fig. 1, the connection for an ordinary energy measurement. The only differences from Fig. 1 are that in Fig. 2 the connections to the shunt coils of the two elements are interchanged and the connection to one of the series coils is reversed. The coil to be reversed depends on whether leading or lagging kilovolt-amperes are to be registered. In Fig. 1, as is well known, the current and voltage of each element are 30 deg. out of time-phase at unity power-factor. In Fig. 2 they are 90 deg. out of time-phase, and hence register zero at unity power-factor. The readings of the meter in Fig. 2 are to be multiplied by a constant, $\frac{\sqrt{3}}{2}$, to obtain the reactive kva-hours on the same scale as the meter in Fig. 1 shows kw-hours. The connection has been described for integrating meters so as to apply to the purchase of energy, but it may be used, if desired, for indicating or graphic instruments for showing real and reactive power.

The above method of charging for the reactive energy separately from the real energy is applicable to cases where the energy-supply company wishes a leading or a high power-factor from the customer at all times of the day, and this will be presumably only when the customer is close to the generating station. This method may also be applied where no synchronous motors are installed or are likely to be installed and where, therefore, power-factor adjustment is not possible. The disadvantage of this method for most cases is that it discourages any adjustment of the power-factor.

Where the load to be measured is situated at a distance from the generating station the cost of conductors and line construction becomes of importance. This includes not only many cases of city distribution, but all cases where loads are supplied by transmission lines. As stated in a previous paragraph, whenever the distance of transmission is great enough to make the cost of conductors an important factor in the system, the size and number of conductors which must be used for

a certain load are determined, not by their heating, but by the voltage drop. Steady voltage at the load is one of the prime requisites of good electric service, and supply companies spend large sums in extra lines and feeders and in feeder regulators in order to deliver energy at steady voltage. Now, if all loads were of unity power-factor, the voltage variation due to drop in the lines and transformers would be less than at a low power-factor. However, if synchronous motors are installed, they would be very inefficiently used if they merely held the load power-factor at 100 per cent. Large savings in line costs and beneficial effects on the generators may be obtained by operating the synchronous motors strongly "leading" at heavy load and sufficiently "lagging" at light load to hold the voltage constant. In transmission-line work the savings in line costs are so large that it pays a supply company to install synchronous motors and run them without mechanical load, adjusting them either by hand or by automatic regulators to give constant voltage at all parts of the line. It is to be noted that a part of the investment in synchronous motors needed to establish a constant-voltage transmission line can be saved if the customers can be induced by the right kind of contracts to install synchronous motors and continually adjust them for as constant voltage as possible.

The question arises, What rules of power-factor adjustment and what forms of contract will enable a supply company to obtain most benefit from the synchronous machinery installed by customers at some distance from the generating station? Obviously none of the contracts mentioned so far will apply, since they all penalize "lagging" power-factor, and the company now desires "lagging" power-factor at certain times of day.

The simplest case is that of an isolated customer. It seems reasonable that a bonus should be given for each kilovolt-ampere of synchronous motors available for power-factor control, since by means of this machinery the supply company is enabled to make use of a cheap line, which would ordinarily have very poor regulation. But the adjustment of the machinery, either by hand or by automatic regulators, can be left to the customer, since poor adjustment will result in voltage variation, and he himself will be the sufferer.

Where several customers are near together, each would be expected to install synchronous machinery and would receive a bonus in proportion. As regards voltage control, they are in some degree independent, since each can utilize the reactance of his own transformers, as well as that of the supply line, to hold his own voltage constant. But poor adjustment by one might result in voltage variations which another could not overcome, and so a check would have to be kept on the adjustment by means of graphic voltmeters in each customer's station and penalties imposed for careless adjustment.

A clear realization of all the possibilities of power-factor control should result in special contracts between energy-supply companies and energy users, where synchronous motors are installed, which would be of greater fairness and profit to both parties concerned than many of the usual contracts now in force.

Reviewing the above outline, it may be stated that a contract bonus for keeping the power-factor above, say, 85 per cent encourages a customer to keep his induction motors fully loaded but does not induce him to install synchronous machines. A bonus for keeping the power-factor up to 100 per cent may be given directly according to power-factor readings on a graphic instrument, or it may be given by charging at a certain rate for the integrated reactive kva-hours. Such a bonus is advisable where there are no synchronous motors or where it is proper to operate the synchronous motors with a strong field current at all times without any adjustment. In most cases continual power-factor adjustment is very valuable, and a bonus should be based on the available kva rating of the synchronous motors, with penalties when they are not adjusted to give constant voltage. Lagging power-factor at times of light load should not be penalized, but encouraged.

Railroad Aspects of Conservation

One of the committees of the American Railway Engineering Association is that on conservation of natural resources. Its report to the recent Chicago convention of the association is largely devoted to a résumé of the proceedings of the fifth National Conservation Congress held in Washington, D. C., on Nov. 17-20, 1913. The committee, of which Mr. William McNab, of Montreal, Quebec, is chairman, says that the question of the control of water-power might be interesting to the railroad engineer under two aspects—first, in case the railroads contemplate electrifying their systems and handling their traffic by electrical energy; second (and this will be new to many electrical men), "when the use of electric power decreases the consumption of coal to the extent of its interfering with the revenue of the railway and the prosperity of the coal-mining communities." It may be added that this seems to be looking a long way ahead.

Company Members of the National Electric Light Association

The National Electric Light Association now has some 1,080 Class A members among the electricity-supply companies of the United States, its possessions and several foreign countries. Of this number almost exactly one thousand are contained within the borders of the forty-eight States, as shown on the accompanying map, which reveals the distribution of these member companies by the arrangement of the small dots. New York

DISTRIBUTION OF MEMBER COMPANIES

leads among the States, with ninety-nine companies; Pennsylvania comes next, with seventy-six; Iowa has fifty-six and Illinois fifty-one. Among the outlying possessions of the United States, Alaska has one member, Hawaii two, the Philippines two and Porto Rico three. The Canadian membership of fifty-eight is led by the Province of Ontario, with thirty-six companies. The list of members in foreign lands includes the following: Argentina, two; Brazil, four; Cuba, one; England, three; Germany, one; Japan, one; Mexico, one, and Venezuela, one.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Profit Sharing in a Small Plant

Mr. N. J. Brown, secretary and treasurer of the Mount Pleasant (Mich.) Light & Fuel Company, has announced that, beginning with Jan. 1, the company placed in operation a plan of sharing profits with its regular employees, who number about thirty-five. On Jan. 1, 1915, each employee will receive a certificate of deposit representing 6 per cent of the amount of his yearly wage. Mr. E. M. Jefferson is superintendent of the plant.

A Convincing Tungsten-Lamp Window Display

The Narragansett Electric Lighting Company, of Providence, R. I., is a thorough exponent of the art of window dressing, and at its showroom in the Turk's Head Building regular changes are made in this portion of its display space. Here is shown a recent window effect designed to demonstrate the important steps in the construction and the striking economy of the tungsten lamp. The novel feature of this display comprised three tungsten lamps on one pan of a set of scales balanced against a carbon lamp of the same total watts rating on the other scale pan, the comparison on the basis of light production obviously being greatly in favor of the latter. The scale pans were alternately shifted up and down by a motor-driven mechanism. The photograph was taken by the light of the window interiors derived from tungsten lamps massed in the concealed space at the top of the window above special fixtures which will be described in a future article.

DISPLAY WINDOW OF ELECTRIC SHOP

The Electric Motor and Its Users

"The Electric Motor, Its Uses and Users," is the title of an impressive list of local motor-service applications just issued by the Edison Electric Company of Lancaster, Pa., in the form of a forty-page pamphlet for distribution locally. Installations of 1 hp and over are included in the list, which embraces more than 600 names of motor users. A number of halftone illustrations of local plants employing electric drive brighten the pages of the book, and at the end there is an appendix of application pictures sure to prove suggestive to prospective customers. According to Mr. H. J. Von Nieda, superintendent of the commercial department of the Lancaster company, the connected load of motors on the Edison system has grown as follows:

	Hp		Hp		Hp
1908	2965	1911	5519	1913	9291
1909	4233	1912	6825	1914	12,154
1910	4897				

Fifteen motor-driven refrigerating plants are now connected to the lines of the company. One of these customers, who has a 5-hp outfit in his meat market, testifies as follows: "Our motor-driven refrigerating plant is not only working satisfactorily, but beyond our expectations. Our refrigeration is now not only cheaper, but cleaner and handier in all respects. During May, 1912, with ice at 30 cents a block, it cost us about $75 for ice alone. Our electricity bill for operating the refrigerating machine during May, 1913, amounted to $14.71. We are sorry we did not make the change years ago."

Storage Batteries in Central-Station Service

Mr. T. Milton, district engineer for the Electric Storage Battery Company in Chicago, gave a talk on "Storage Batteries" at the luncheon of the Chicago Jovian League recently. Mr. Milton referred to the great size and variety of applications of storage batteries. He spoke particularly about central-station installations, saying that the Commonwealth Edison Company, in particular, has batteries sufficient to take the maximum direct-current load on the system for eighteen minutes. The big central-station companies in Boston, New York, Chicago and other cities are purchasing additional batteries from year to year to keep up with the peak demand of their direct-current load. The speaker described the use of emergency or stand-by batteries, regulating or peak batteries, exciter batteries, oil-switch batteries and ignition-system batteries for large gas-engine plants. In relation to the first class he told of the comparatively modern use of thin pasted plates in large central-station cells. He spoke of some large stand-by batteries that will carry over 400 amp for ten minutes. In relation to regulating or peak batteries Mr. Milton said that the electric-railway storage battery on Plymouth Place, Chicago, is figured to save $57,000 a year by flattening out the peak of the demand of the electric-railway companies, which purchase central-station energy.

Dry-Goods Delivery by Electric Vehicles in Winter

The accompanying data show the work done during a winter month by a Detroit 1000-lb. electric delivery wagon having a sixty-cell Edison battery, which is operated by a department store at Providence, R. I. This vehicle has been in continuous service, regardless of weather conditions, since Oct. 1, 1913, and is used in a section of Providence where it must climb grades ranging from 4 per cent to 15 per cent. Four regular trips are made each day over a route on which horses could make only three trips. The illustration shows the conditions on Feb. 20 directly after the worst blizzard of the season. On this day, it is interesting to note, only 70 amp-hr. was consumed over a distance of 10 miles, during which thirty-five packages were delivered.

ELECTRIC TRUCK MAKING WINTER DELIVERIES

Complete operating records are kept by the store so that the exact cost of operation may be known. The January report reproduced herewith is of special interest, as it shows an average cost of 3.64 cents per package delivered.

PACKAGE DELIVERY DURING JANUARY, 1914

Date	Packages	Miles	Amp-hr.	Kw-hr.
1	175	30	140	27
2	200	35	140	20
3	200	35	140	20
5	175	33	150	19
6	175	35	135	17
7	200	35	150	18
8	175	35	140	19
9	200	36	140	22
10	250	37	150	20
12	175	35	140	18
13	175	30	140	20
14	200	35	135	20
15	200	36	140	20
16	200	35	140	20
17	250	37	150	22
19	150	33	135	16
20	200	35	140	18
21	175	35	160	17
22	200	36	145	24
23	225	37	140	20
24	250	36	150	28
26	150	30	135	20
27	200	35	140	16
28	200	35	140	22
29	225	36	145	21
30	200	35	140	20
31	250	37	150	26
Total	5375	.....	3850	550

COST OF OPERATING DELIVERY WAGON

550 kw-hr. at 6.5 cents per kw-hr	$35.75
Garaging	20.00
Battery maintenance	8.50
Tires (estimated life twelve months)	10.00
Miscellaneous repairs and upkeep	8.25
Painting and varnishing	4.25
Interest and depreciation	18.75
Total	$105.50
Driver and boy	90.00
Cost of delivery 5375 packages	$195.50
Delivery cost per package	3.64 cents

Tactful Relations with Customers

In the course of a recent address to an audience of young electrical men Mr. John W. Ferguson, assistant to the general contract agent of the Commonwealth Edison Company, Chicago, said that in the commercial side of the electric-service industry the technically educated man must not look down upon the non-technical man. He declared that a technical man without business ability or training may "exist" and that a business man without technical training may "progress," but that the business man with technical knowledge is "bound to succeed." Mr. Ferguson also made the point that to the misuse or careless use of the telephone by employees is due much of the ill feeling exhibited by the public toward public-service corporations. Too much care cannot be exercised by the department manager in impressing on the minds of those under him the necessity of courteous treatment of all telephone inquirers. To school those whose duties bring them in frequent daily contact with the public over the telephone to be patient, polite and exact is a task of no small magnitude; but it is one that cannot fail to commend itself to the men in authority who study the situation with care.

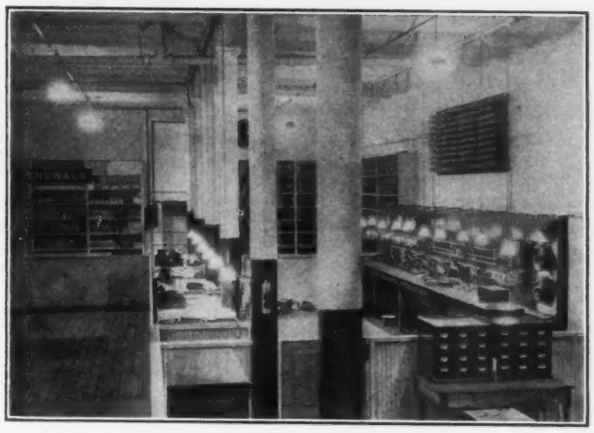
All the men connected with the company should bear in mind the necessity of maintaining pleasant relations with customers. Mr. Ferguson said he had known men whose primary duty it was to cut off customers for non-payment of bills but who performed their duties in such a manner that not only was the customer not cut off, in some particular case, but he was transformed into a good friend of the company. The necessity of discussing electrical matters with customers in familiar English and not in technical terms was pointed out. To the solicitor Mr. Ferguson made the point, out of his large experience, that in the long run it is sincerity that wins business and holds it. The agent should not be arbitrary in his statements but should "use all gently." However, he should "be not too tame" either. Complaints should be carefully investigated and if justified they should be remedied quickly and cheerfully.

Setting the Example with Good Illumination in Company's Buildings

When a customer or a prospective customer of the Columbus (Ohio) Railway & Light Company signifies his intention of installing electric fixtures or increasing his present installation, the new-business department of the electric-service company furnishes him with suggested plans of an installation which it believes will be suitable and will serve his purpose. This work is handled by the solicitors of the new-business department, each of whom is capable of advising the customers in the capacity of an illuminating engineer. These specifications when drawn up give the prospective customer something concrete from which to talk and also furnish him with a set of plans which he may take to several contractors in the city to determine what the installation is going to cost. The specifications cover

number and spacing of outlets, type of fixtures suitable for the particular business, height of units from the floor, type and size of lamps, reflectors, and method of

During the past year the company has been not only preaching good lighting but also practising its own doctrine, as will be noted from the accompanying night control.



LIGHTING IN METER ROOM AT COLUMBUS, OHIO

picture taken in its meter-testing department. On the extreme right is a rack for testing apparatus which is brilliantly illuminated by means of tungsten lamps suspended by drop cords and shaded by green reflectors. At the opposite side of the aisle a similar workbench, illuminated with the same type of units, is used for making small repairs. General illumination is furnished by tungsten lamps in glass reflectors suspended about 2 ft. from the ceiling.

Variation of Energy Consumption in Brick Plants with Condition of Clay

The use of clay of different consistencies affects the cost of brick-making, so that costs for the same factory may vary widely during different months of the year as the weather affects the character of the soil. The accompanying table shows how the maximum demand for common machines employed in the manufacture of bricks varies in a Utah factory where press and wire-cut brick are made. The highest maximum

MOTORS IN BRICK PLANT

Application	Maximum Demand in Kw.
One 40-in. disintegrator, belt-connected to one 40-hp, three-phase motor	36.4–50.4
One pug mill belted to 50-hp motor	43.0–44.0
One wire-cutting machine, 50,000 bricks in ten hours, belted to 50-hp motor; also two belt conveyors	51.0–64.0
Two four-mold pressed-brick machines, 20,000 bricks in ten hours, belted to 30-hp motor	12.0–12.0
One 11-ft. blower and one 13-ft. blower, 222 r.p.m., belted to 35-hp motor	43.0–50.4

demands, as would be expected, were registered during the early spring months, when the clay was in a sticky state.

Energy is transmitted to the mill at 28,000 volts, being stepped down to lower pressures for motor service and lighting. Data based on the company's annual output and energy consumption show that 22 kw-hr. represents the requirement in the manufacture of every 1000 bricks.

Illumination and Wiring

Nitrogen-Filled Lamps for Moving-Picture Machines

The Seattle (Wash.) municipal lighting plant operates no 110-volt direct-current circuit, and for the use of local stereopticon and moving-picture machine operators Mr. J. D. Ross, superintendent of the Seattle Lighting Department, has had developed a special form of nitrogen-filled stereopticon lamp. One of these, for operation on a 125-volt circuit, is a 700-cp unit. Another type, rated at 400 cp, operates on a 10-volt transformer, making a very rugged filament. In both cases the filament is concentrated as far as possible at a point. The new lamp is intended to replace the direct-current arc for all stereopticon work. For this use it promises to be exceptionally good, and by eliminating the flickering of the arc it will make moving pictures appear more steady.

Mounting of the San Francisco Exposition "Jewels"

As already noted in these columns, some 10 tons of cut-glass "jewels" are to be employed in the decorative lighting of the Panama-Pacific International Exposition buildings. To support these sparkling gems of hard flint glass in the rays of the projector lamps, special holders are now being designed. A metal ring 0.125 in. wide will encompass the jewel on its outer edge, and a second holder at the back will bring a small mirror against the apex of the jewel. It is estimated that the brilliancy of reflection will be increased more than 40 per cent by the use of this mirror. Each jewel will be hung by a small handle with a 0.25-in. hole on a 0.125-in. hook. This arrangement permits of free movement in any direction and practically amounts to point suspension. The jewels measure 1.85 in. in diameter. They are molded in Austria from an exceptionally hard flint glass and are afterward hand-cut and polished by peasants who have learned to do this work.

A 951-Ft. Transmission Span Clearing Navigation

The British Columbia Electric Railway Company, of Vancouver, B. C., has just installed a new 34,600-volt transmission span over the Second Narrows of Burrard Inlet, to supply energy to North Vancouver and adjacent districts. The span measures 951 ft. between towers and at its lowest point clears the water by a height of 160 ft. in order to permit large vessels to reach industrial plants at the head of the inlet.

The new masts are of double-pole or "H" construction, each being composed of two-pole masts, placed 18 ft. apart. The north mast is 210 ft. high and the south mast 215 ft. high. On the north side the masts are guyed to a two-pole anchor tower itself 130 ft. in height, while the south mast is tied to a four-pole anchor tower 95 ft. high.

The masts carry eight wires, these consisting of two 34,600-volt, three-phase circuits, and two telephone wires. The 34,600-volt wires are of galvanized plow-steel wire, each made up of six strands of seven wires. Each wire is of 2500-circ. mil area. The core is of hemp, and the cable itself measures 0.5 in. in diameter.

The two circuits are placed side by side 6 ft. between centers, in a vertical plane. The middle wire is offset 2 ft. to increase clearance when snow or sleet

may prevail. The telephone wires are placed at the ends of the cross-arms.

Complete transfer of the transmission lines from the old masts to the new construction was effected Feb. 21. As this is the only connection with the company's North Vancouver substation, which supplies energy for a railway system and for public and private light and motor-service business, it was necessary that the interruption caused by the transfer of the wires be as brief as possible and at such times as would inconvenience the company's patrons but little. The transfer was made on three Sunday mornings, the average length of interruption on each day being about two hours.

Lighting and Illumination Tests in Central-Station Offices at Ann Arbor, Mich.

The new home of the Eastern Michigan Edison Company at Ann Arbor, Mich., presents an example of carefully designed semi-indirect lighting, an interesting feature of the installation being the complete absence of desk lamps and bracket or extension fixtures in the large office and display rooms shown in the accompanying illustrations.

FIG. 1—EXTERIOR ILLUMINATION OF NEW OFFICE BUILDING, ANN ARBOR, MICH.

The building is a three-story structure of reinforced concrete and steel, including a basement. The first floor is occupied by the general offices, cashier's office, trouble-men's desks, display tables and salesmen's desks, and is made attractive by large display windows fronting on two streets. A large room across the hall contains the transformers and other substation equipment. The second floor is given over entirely to desks, the private office of the division manager and the private telephone exchange. Another room on this floor contains the meter-testing department and a drafting room.

FIG. 2—ENTRANCE VESTIBULE, SHOWCASE AND DISPLAY TABLES

As indicated by the dotted lines (Figs. 4 and 5), the rooms are divided off into 12-ft squares by beams 14 in. wide and extending down 11 in. from the ceiling. The pillars are 14 in. on a side and are indicated by small squares on the drawings. All of the switches which control the fixtures are of the push-button type and are mounted in the sides of these pillars. The walls and ceilings of both floors are white in color with no trimming, except the light golden-oak finish of the woodwork, which matches the desks.

TABLE OF PHOTOMETER READINGS.

FIRST FLOOR		SECOND FLOOR	
Station No.	Illumination in Ft.-Candles	Station No.	Illumination in Ft.-Candles
1	2.04	1	2.11
2	2.48	2	2.30
3	2.50	3	2.86
4	3.19	4	1.15
5	3.47	5	2.27
6	2.05	6	3.39
7	1.13	7	3.65
8	4.55	8	1.65
9	3.39	9	2.38
10	3.51	10	3.83
11	4.25	11	3.91
12	3.65	12	3.02
13	2.63	13	2.31
14	1.08	14	3.56
15	8.47	15	4.34
16	3.58	16	4.01
17	3.86	17	3.71
18	3.94	18	2.25
19	4.22	19	2.35
20	2.71	20	3.54
21	1.16	21	4.44
22	....	22	3.98
23	4.09	23	3.92
24	3.82	24	2.58
25	1.54	25	1.99
26	3.41	26	2.94
27	3.45	27	3.68
28	2.95	28	3.64
29	3.39	29	3.64
30	6.90	30	2.60
31	2.19	31	1.82
32	1.81	32	1.99
33	1.95	33	2.68
34	2.53	34	2.29
35	2.08	35	2.25
..	....	36	2.08

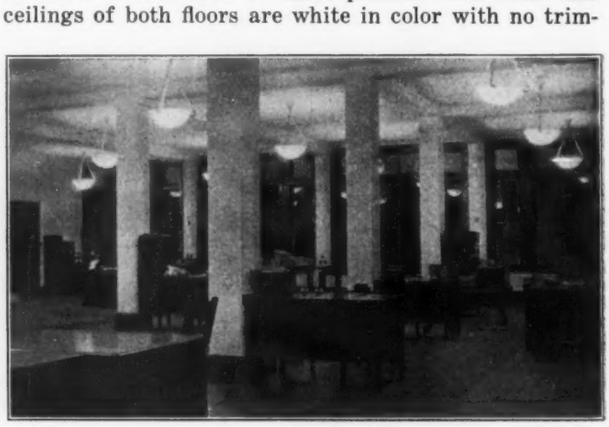


FIG. 3—OFFICE SPACE ON SECOND FLOOR

Thirteen Alba "semi-indirect" fixtures are used to light the first floor and sixteen the second. On the first floor where the ceiling is 12 ft. 9 in. high the bottoms of the bowls are 3 ft. from the ceiling, while on the second floor, although the ceiling is 11 ft. 10 in. high, the

same type of fixture is used. Each bowl contains three 60-watt tungsten lamps placed horizontally, the center of the lamps being 30 in. from the ceiling and 2.5 in. from the tops of the bowls. The diameter of the bowl used is 21 in.

One 60-watt tungsten lamp in a frosted dome furnishes sufficient light for the main entrance vestibule. This entrance has a ceiling of its own and is entirely separate from the rest of the office, except for large double doors with glass. The walls are also of glass paneled in heavy woodwork.

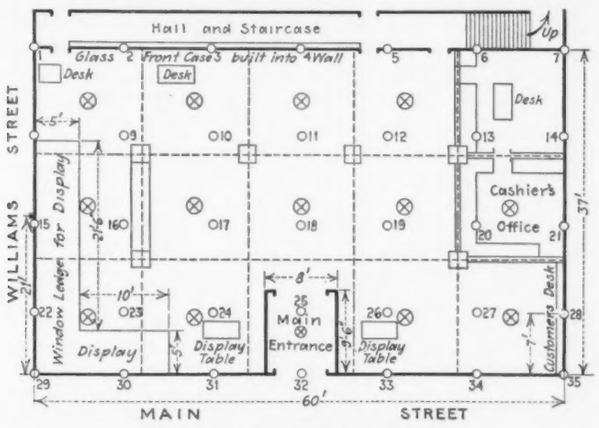


FIG. 4—FIRST-FLOOR PLAN

In the diagrams the position of each fixture is indicated by a small circle inclosing a cross, while the stations where photometer readings were taken are shown by small blank circles. The stations are 10 ft. apart each way, but those stations which are indicated as being on dividing walls are understood to be 6 in. from the wall.

The accompanying photographs were taken at night with a hand camera, using only the light from the tungsten installation. The times of exposure averaged ten minutes. The clearness with which articles on the desks and in the showcases are seen shows how well absence of glare and uniformity of illumination have been obtained.

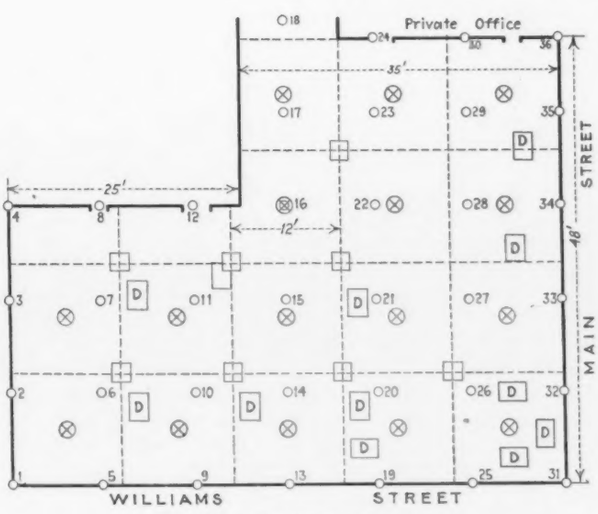


FIG. 5—SECOND-FLOOR PLAN

In Fig. 6 the illumination in foot-candles on the second floor is plotted as ordinates and station numbers as abscissas. Reference to Fig. 3 will show the location of the curves.

The window illumination has been increased by placing fourteen 40-watt tungsten units on the Williams Street side above the window ledge and seven 40-watt tungstens on the Main Street side. These lamps are equipped with Holophane metal reflectors.

The average of four readings on the cashier's desk inside the cage, which is directly under a fixture and 4 ft. above the floor, was 3.51 ft.-candles. Office employees are much pleased with the new system.

The average illumination was found to be 2.85 ft.-candles for the first floor and 3.12 ft.-candles for the second floor. The lamps were rated at 113 volts, but were burned at 112 volts. The average illumination corrected for this difference in voltage would be 2.97 ft.-candles and 3.25 ft.-candles respectively.

The total lumens emitted was determined by using the value 8.45 lumens per watt, which gave $13 \times 3 \times 60 \times 8.45 = 19{,}773$ lumens for the first floor and $16 \times 3 \times 60 \times 8.45 = 24{,}320$ lumens for the second floor.

The efficiency of the illumination was determined by using the relation:

$$\text{Efficiency per cent} = \frac{\text{floor area} \times \text{av'r'ge ft.-candles} \times 100}{\text{total lumens emitted}}$$

For the first floor this gave:

$$\frac{2144 \times 2.85}{19{,}773} = 30.8 \text{ per cent.}$$

and for the second floor,

$$\frac{2430 \times 3.12}{24{,}300} = 31.2 \text{ per cent.}$$

All readings were taken with a calibrated Sharp-Millar photometer with test-plate 30 in. above the floor.

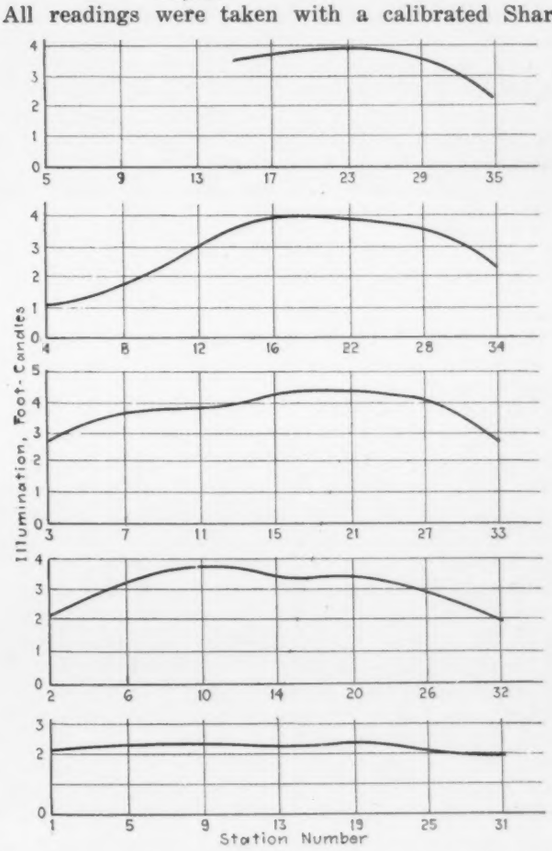


FIG. 6—INTENSITY OF ILLUMINATION ON SECOND FLOOR

The above observations were made by Messrs. W. L. Bice, E. A. Hurme and E. H. Gillette under the direction of Prof. H. H. Higbie, of the electrical engineering department of the University of Michigan, and through the courtesy of Mr. R. W. Hemphill, Jr., of the Eastern Michigan Edison Company.

Electrical Decorations at Rotary Club Banquet

At the annual banquet of the Pueblo (Col.) Rotary Club, held last month, the electrical decorations were pleasing and rather elaborate. At one end of the hall a large wheel outlined with many electric lamps rotated throughout the evening, energy being supplied by means of brush contacts on the main shaft. The tables in the hall were arranged in the form of a wheel having one large table in the center for the hub and smaller tables radiating from it to resemble the spokes. Comparable to the felloe of the wheel was a railing, in which gateways between the "spokes" provided access for guests and waiters. On this rim of the wheel were 4-cp yellow and green lamps, 8 in. apart, controlled by a twenty-four-point flasher giving the effect of a wheel turning on its axis. Mr. W. F. Raber, manager of the Arkansas Valley Railway, Light & Power Company, is a valued member of the club, and Mr. E. F. Stone, lighting and power superintendent of the same company, had charge of the electrical decorations.

Seattle's Nitrogen-Filled Street Lamps After 1000 Hours' Burning

One of the first shipments of nitrogen-filled high-efficiency tungsten lamps produced was delivered to the Seattle (Wash.) street-lighting department and immediately put into service there for a commercial test. As described on page 98 of the *Electrical World* of Jan. 10, 1914, these 6.6-amp, 56-watt units are operated from special 8-volt transformers, a separate transformer in the base of each five-lamp cluster pole supplying the corresponding five lamps in multiple.

By the first week in March, according to Mr. J. D. Ross, superintendent of lighting for the city of Seattle, forty of the cluster-pole lamps first put into service had been burning more than 1100 hours. These lamps give a beautiful white light, he adds, making the ordinary tungsten units look yellow in comparison.

Of the forty cluster-pole lamps installed, some had to be placed inverted, although this was then not supposed to be desirable. Experience has now shown, however, that the lamps seem to work equally well either way. Eight have burned out thus far, but the remainder appear to be still in excellent condition.

At the time the curb-post installation was made thirty-three lamps of the same size and having "Mogul" bases were installed on the city's arc circuits in series with the arc lamps. These have also now passed the 1100-hour mark. There have been eight replacements on account of burn-outs, but the remaining lamps show practically no signs of deterioration or blackening.

In addition to the lamps above mentioned the Seattle system has in service about 500 8-volt, 80-cp nitrogen-filled lamps fed from low-voltage transformers and about 500 others operating in series on the 6.6-amp series arc circuits. These and a smaller number of large lamps also in service have averaged to date about 800 hours' burning, but show thus far no evidences of deterioration.

The Packard lamp division of the General Electric Company, which furnished the nitrogen-filled lamps above referred to, has also developed for the use of the Seattle lighting department a large high-efficiency incandescent unit with which to replace arc lamps on the city's streets. These lamps are being placed in service as rapidly as possible and will, it is declared, double the candle-power of every street lamp in the city without increasing the consumption of energy.

Letters to the Editors

The Boundaries and Divisions of Standardization

To the Editors of the Electrical World:

SIRS:—An experience of many years in the standards committee of the American Institute of Electrical Engineers and the fact that the writer has recently become president of the Electric Power Club which has done much work in the standardization of electrical machinery have caused him to consider the proper jurisdiction of the various organizations interested in the subject.

Fundamentally there are three broad divisions of standardization—first, scientific; second, technical, and, third, industrial. True examples of scientific standards are the resistivity and temperature coefficient of copper. A proper matter for technical standardizing is the safe temperature limits of the various kinds of insulating material. As clear cases of industrial standardization may be cited the shaft diameters and speeds of different types and sizes of electric motors. A scientific problem should be handled by the United States Bureau of Standards or the American Physical Society. A technical electrical matter should be decided by the A. I. E. E., and an industrial electrical question properly belongs to the National Electric Light Association or the Electric Power Club.

The best way to solve the problems of standardization is not by conferences between a number of bodies acting jointly on the various subjects. Of course, co-operation is very desirable in some cases, but in dealing with many matters it is unnecessary. Standardization should be carried on in accordance with the following general scheme: First, each organization should have definite jurisdiction, within which it should have full authority. Second, each organization should as far as possible confine its action within its own jurisdiction. Third, when questions arise that are on the border, or when the authority and interest of two or more organizations overlap, then a conference between the interested parties should be held.

In order to determine jurisdiction, the following plan of procedure may be adopted: When any organization considers it desirable that something shall be standardized, its secretary shall communicate that fact to the secretaries of the other bodies likely to be interested in the same subject. Communications between the standards committees are not sufficient, because there may be several in one society and they may change from year to year. In most cases, from the nature of the particular matter involved, it is clear that it properly belongs to a certain organization, and the others will accordingly acquiesce. In other instances it is evident that a question is on the boundary between two bodies, and they will therefore agree to co-operate in acting upon it. Of course, failure to answer such a communication within a reasonable time would be tantamount to an abandonment of any claim to the matter involved. When there is doubt or difference of opinion as to jurisdiction that cannot be settled by correspondence between the parties interested, then the case may be referred to an arbitrator, for example, the director of the United States Bureau of Standards or the president of one of the national engineering societies not interested. The arbitrator merely decides which body or bodies shall have jurisdiction over that subject. The actual standards are determined by this body or bodies.

The first standardization of electrical apparatus and methods was the work of the A. I. E. E. several years before anything of the kind was done in other countries. In fact, it was the first comprehensive scheme of standardization generally adopted in any branch of science,

technology or industry. At first the Institute was the only body competent or willing to undertake such work, and the standards were so general that they were important to almost all the branches of electrical engineering. Hence there was no question of jurisdiction at that time. Now there is much specialization with many organizations to cover the various branches. For example, the American Electrochemical Society and the Illuminating Engineering Society are strong and active in their respective fields, which are more or less included in electrical engineering. These are technical bodies of the same general character as the A. I. E. E., and there are also organizations largely industrial, such as the N. E. L. A. and the Electric Power Club, composed of manufacturers of electrical machinery, which cover much of the same ground as the A. I. E. E. but from a different standpoint.

On account of the very rapid differentiating and specializing in electrical science, technology and industry it would seem that some general plan is needed for present and future standardization. In some cases it is quite evident that a certain body should have sole authority over a certain subject. For example, the electrochemists as a body should certainly determine all standardizing in that branch in spite of the fact that hundreds of members of the A. I. E. E. are also interested in it. An organization of men who devote themselves to a particular subject should be able to determine standards for it more correctly and more quickly than the A. I. E. E. This is true even though a committee or sub-committee is selected for its special knowledge of the subject, because the Institute as a whole is not qualified or interested to act upon the report of such a committee, however good it may be. Special subjects should be dealt with by those who live with them, so to speak, devoting their thoughts and efforts to them.

In all matters affecting standards it is of the utmost importance to give them very careful consideration. It is much better to have no standard than to have an ill-advised one or to have different standards for the same thing. It is hard to rectify mistakes of this kind. In looking back over the history of electrical and other standardizations, we see that the tendency has been to standardize too quickly, too often and too much. There have been dozens of wire gages; for example, electrical books in the English language may use the American, Birmingham or the standard British gages, each materially different from the other two. Many superfluous technical terms have also been introduced. Experience, therefore, indicates that we should be conservative in establishing standards. This is another reason why each organization should limit its action to those matters which it best understands. Thus fewer mistakes and at the same time better progress are likely to be made. All standardization committees should be careful not to rush in where angels fear to tread.

It is surely a mistake for any organization to reach out and attempt to standardize in any field that does not clearly belong to it. Each organization already has far more that is unquestionably within its province than it can possibly cover, and new ground is being rapidly opened up. The standards committee and subcommittees of the A. I. E. E., for example, have been working very hard for two years on a revision of its standardization rules. The general scope is not much greater than that of the former rules, but the new ones will be much more correct and complete. Nevertheless, there are many points that it would be desirable to cover more definitely, and a number of branches of the subject could advantageously be extended and important new matter added. Certainly the duty of the Institute is to cover its own particular field thoroughly before it seeks out or wanders into other fields to which its title is even questionable.

The Electric Power Club has one general standards committee, and there are eight sub-committees, each devoted to a particular class of electrical machinery, for example, one for large alternating-current generators, another for large direct-current generators, etc. A great deal has been and will be accomplished, but there is much more ground than it is possible to cover properly even though the work is strictly confined, as it should be, to the sizes of shaft, pulley, etc., speeds, nomenclature, ratings for different service and other matters that are industrial in contradistinction to those that are technical or scientific.

A great deal of trouble is caused to manufacturers and users of machine tools owing to the varying types, sizes and speeds of electric motors employed to drive them. Hence, the standardizing of motor dimensions for machine-tool drive is very desirable. This is solely an industrial matter that should be dealt with by the Electric Power Club and the National Tool Builders' Association acting jointly. Neither the A. I. E. E. nor the American Society of Mechanical Engineers should have anything to do with it, because it is clearly outside of their jurisdiction. As a matter of fact, it has been considered by committees of both of these bodies. Little has been accomplished, however, because it was thought necessary to consult all four organizations, and everybody's business is nobody's business.

New York, N. Y. FRANCIS B. CROCKER.

Consulting Engineers and Manufacturers

To the Editors of the Electrical World:

SIRS:—Last Friday evening, at the annual "electrical night" of the New York Railroad Club, after some descriptive remarks on electrification work progressing under his supervision, Mr. George Gibbs discussed in very strong terms the relation of American electrical manufacturing companies to electrification engineering. It has been customary on these occasions to allow to those invited to speak the utmost freedom in the choice of subjects, and no manuscript is asked for in advance. They are invited to discuss whatever phase of electrical engineering is, in their opinion, important. This particular subject has been frequently and energetically discussed in the past, but always in private. Its importance is so great that it should be discussed publicly, and Mr. Gibbs doubtless desired to take advantage of a time and place where he could open the discussion on his own responsibility.

If I understood Mr. Gibbs correctly, his position is

(1) That electrical manufacturing companies in the United States have shown that they desire to sell plant and to project engineering in addition to their legitimate business of selling manufactured goods.

(2) That the excellence of their apparatus is beyond question, but that their engineering for the use of this apparatus is too frequently mere salesmen's tactics. Such engineering, of necessity, is bound to be more or less governed by commercialism, and is, therefore, likely to be unsound.

(3) That it seems to be considered good business for these companies to advocate strongly the particular system of electrification in which they have a proprietary advantage or which has, for them, some other commercial advantage.

(4) That their practice is not economically sound and should be changed for one of hearty co-operation with designing and assembling engineers outside their organization. The manufacturing companies should limit their energy to perfecting the apparatus they sell.

Mr. Gibbs is right in his first point. The manufacturing companies do sell engineering. Whether the customer pays for it directly or indirectly he pays, and, therefore, it is sold. The companies either do it voluntarily or because, from their point of view, they are forced to do so. There are many reasons for thinking that they do not do it voluntarily. In fact, it is known that they believe circumstances force them to do it. What are the circumstances?

They desire to sell apparatus for electrification. Before this apparatus can be sold a large amount of expensive engineering investigation is necessary. Moreover, the prospective purchaser is usually lukewarm and needs plenty of inducing. Now, says the manufacturing company, either the outside engineer cannot afford to, or will not, do this preliminary work unless the prospective client will pay for it all. This the railroad president or general manager is not sufficiently interested to do, except in a few cases. Therefore, say the manufacturers, we must do it or sit idly by and not apply the same salesmanship that we apply in other departments. We should like to work with the consulting engineer, but we cannot let him obstruct our business.

This is perhaps true, and if this were the place, I should like to tell some of the woes that I think will come to consulting engineering in this country unless those practising it apply some salesmanship to it. Engineering may be a profession, but consulting engineering is not. It is a business.

Mr. Gibbs is right in his second point. The manufacturing company engineer is tinged with commercialism. Would he ever recommend, for example, that something be purchased from a rival company? In nine cases out of ten he is doing free work apparently, which, however, is to be paid for when the apparatus is purchased. This has nothing to do with the engineer himself or with his integrity. He may be better informed than any consulting engineer in the country. He may be just as close to operation as any but one or two of the "electrification engineers" of the country to-day. But in all his work there is the purpose to sell apparatus for his company. He is an advocate, not a judge. He could, under other circumstances, do as well as any engineer in the world. The circumstances of his position are at fault—not he himself. There is ample analogy in the law. The lawyer pleading before the bar may know twenty times as much as a judge, but he is not allowed to pass judgment. The lawyer may cease to be a lawyer and become a judge to-morrow, but he himself is not different. He can and will render a just decision, however, because circumstances permit him to do so.

I do not believe that the companies or their engineers ever advocate something unfitted for the project merely because it would be to their commercial advantage. I have too much confidence in their integrity. The worst that I am willing to charge is an honest but warped judgment, due to circumstances. The truth is that their experimental work is successful along certain lines. The resulting enthusiasm leads them, as it would lead any one, to attribute more versatility to the child of their energy than is really possessed. This, however, is only another reason why they are incapable of deciding conservatively when the interests of others clash with their own. So far as the undue advocacy of systems is concerned, it is fair to the manufacturing engineer to say that the two foremost and vociferous advocates of rival systems to-day are not manufacturing but operating and consulting engineers. And, further, from the standpoint of knowledge, several of these outside engineers have had comparatively little experience with any system except the one which they advocate so strongly.

From every possible point of view, I agree with Mr. Gibbs in his belief that the manufacturing company and its engineers should withdraw from all electrification engineering except that necessary to design and construct properly the apparatus they sell. I do not believe this because the present policy may be against the pecuniary interests of the consulting engineer. The consulting engineer who is not able to cope with a factor of this kind had better be in some other business or practising engineering under a salary. I do believe it, however, from the standpoint of the manufacturing company itself, and more particularly from the standpoint of the purchaser or client. If the manufacturing companies want to do this work, it would be far better for them to form and finance a separate and distinct organization for the purpose. It is a mistaken policy, in my opinion, to add the very great costs of this engineering to the overhead costs of manufacturing. Moreover, they are undertaking work which a manufacturing organization is not equipped to do properly. They are assuming the responsibility of making a variety of apparatus work together properly, when, in reality, the greater part of their energy is spent on the design and construction of certain portions of the apparatus.

And what about their treatment of the purchaser? Is it fair for them to go to him and say that he can safely intrust his whole problem to them, with the assurance that he will get the very best solution, when at the outset they mean to exclude practically all other manufactured material except their own? If they knew, by any chance, that a rival interest had something to sell which would be much better for the client than that which they themselves manufacture, could they possibly offer it? In the last analysis, is there not a certain moral dereliction in carrying the usual methods of salesmanship so far and apparently offering something for nothing?

Would they honestly contend that such a method is a safe one from the standpoint of the client?

The serious question, however, is: Are the manufacturing companies compelled to do this? I know that there are weak so-called consulting engineers. I know that any consulting engineer in such an art as electrification, with its very rapid development, must lean very heavily on the engineers of manufacturing companies. Would it not be better, however, for the manufacturing company to insist, for its own protection, that a consulting engineer of sufficient ability be connected with the work, unless there is an operating engineer with time and ability to serve on the part of the client?

I think the real difficulty in this particular connection is with the consulting engineer. I doubt very much whether, in spite of what the manufacturing companies are doing to-day, they would not prefer to have a good, strong consulting engineer work up the project; but the ordinary consulting engineer is usually too much of a professional gentleman waiting for someone to retain him. He is too willing to stand by until the railroad manager decides to electrify and wants someone to tell him how to do it.

I do not mean at all that he ought to go out and, in the ordinary way of a commercial salesman, solicit work. Nevertheless, it seems almost too altruistic to ask manufacturing companies to-day to do investigation work in order to prove the advisability of further study of a certain project and then recommend that the railroad employ an independent consulting engineer who may or may not give them business. I think Mr. Gibbs, therefore, is correct in his criticism, but the discussion certainly should proceed to a recommendation as to what should be done. For my part, whatever this recommendation may be, I am convinced that the consulting engineer must do something on his own account which he has not done heretofore.

New York, N. Y. WILLIAM MCCLELLAN.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Operating Methods in Large Steam Power Plants

About 250 members and guests at the dinner meeting of the Chicago Section of the American Society of Mechanical Engineers held at the Hotel Sherman on March 18 listened to interesting discussions of large steam-power plants. The speakers of the evening, Messrs. I. E. Moulthrop of Boston, W. J. Parker of Detroit, John Hunter of St. Louis and W. L. Abbott of Chicago, are men in responsible charge of some of the largest steam-power plants in this country. Abstracts of their opinions on the subjects discussed are given in what follows.

For Greater Plant Efficiency Begin in the Boiler Room

After commenting upon the broadening influence that joint meetings of technical societies have on engineers, Mr. I. E. Moulthrop said that he thought increases in plant efficiency in the future would be obtained by giving additional attention to boiler-room operation. Although there are at present many accurate instruments for measuring and recording the operation of the electrical end of a station, instruments for boiler-room work have not as yet reached a desirable degree of accuracy. Speaking of boiler-room instruments now in use, Mr. Moulthrop said that the visual load indicator was generally the first helpful device installed. Of other instruments he said that he thought the CO_2 recorder very good as a laboratory instrument but as yet hardly practicable for boiler-room use. The steam-flow meter was characterized as a most valuable aid to the fireman when used in conjunction with draft gages and other instruments.

Discussing the subject of draft, Mr. Moulthrop said that a stack large enough to carry the gases to an unobjectionable height would in most cases supply sufficient draft for the boilers. However, the speaker said that forced draft affords better control. Ideal conditions exist where the stoker operating at normal rating of the boiler uses only natural draft but is arranged so that during the peak forced draft may be utilized, forcing the boiler to 300 per cent of its rating. One unit in the station of the Edison Electric Illuminating Company of Boston thus adjusted is ordinarily raised from 125 per cent load to 300 per cent load in five minutes when the peak comes on the station.

The High-Grade Engineer for the Boiler Room

Inasmuch as the economy of the plant is in the hands of the operating engineer, Mr. Moulthrop contended that the time is past when the high-grade engineer should be placed in the turbine room, leaving the operation of the boiler room in the hands of the fireman. Since the advent of the stoker has changed the aspect of the modern boiler room, making it a light, clean and attractive place, the speaker says there is no reason why this job should not attract better men.

Reliability of Large Boilers

Mr. J. W. Parker, of Detroit, Mich., speaking of the large boilers of the Detroit Edison Company, said that one advantage of the large unit is that the company can afford instruments for each boiler, allowing a closer watch upon the operation of each. As to the reliability of large boilers, he said that they are more to be depended upon than the turbines. The Detroit company has never lost the use of a boiler during the peak, nor has it been obliged to take a boiler from the lines when it was needed. Although the large units were rather clumsy to handle at first, the centralization of all control apparatus at one point has eliminated this disadvantage. Thus far all apparatus is hand controlled as the development of proper types has been gradual and the next step will probably be the design of an automatic machine to care for all of these operations. One change mentioned in connection with the large unit was the elimination of the small steam stoker engine and the substitution of a direct-current motor. Mr. Parker's opinion of the CO_2 machine differed from that of Mr. Moulthrop, and he said that by taking samples of the flue gas at four different points on the same horizontal plane and automatically mixing the gases he had been able to secure readings representative of the condition of the flue gases in the stack. In the Detroit company's station the readings of the CO_2 recorder vary from 10 per cent to 16 per cent, the average reading being in the neighborhood of 13.5 per cent. Mr. Parker said that he was in favor of putting college graduates in charge of boiler-room operations as he believed they not only would gain good first-hand experience there but would be able to render valuable service to the company.

Results of Six Months' Observations in St. Louis

In commenting upon the engineering problems arising as a result of the purchase of energy amounting to 60,000 hp from the hydroelectric plant at Keokuk and the consequent invention of a quick-firing method for steam boilers, Mr. John Hunter, chief engineer of steam plants Union Electric Light & Power Company, St. Louis, Mo., said that it is vital to keep dampers closed in such quick-firing boilers. Circulation of air should be prevented so that the brick settings will be kept hot. From observations it has been found in St. Louis that the firebrick suffers very little from the flames when the fires are started if these precautions are taken. Investigation has shown, however, that pitting occurs in the boiler drums near the water line. While this action is not serious, it has served to warn engineers that a danger confronts them. The pitting is of such character as to indicate that galvanic action takes place between the metal of the boilers and particles of carbonaceous matter adhering to them. Prevention of immediate further action has been accomplished by thoroughly cleaning the corroded spots, scraping and wire-brushing the entire inside of the drum, and applying two coats of graphite paint, permitting each coat to dry thoroughly. As a further preventive measure the treatment of the boiler-feed water has been changed. Previously the company used a coagulant of lime and sulphate of iron, adding a small per cent of soda ash. Believing, however, that the soda ash caused the concentration of sodium sulphate in the boilers, which served as an electrolyte for the galvanic action, barium hydrate has been substituted for the soda ash. It is hoped that

this chemical will remove all the organic matter and a large percentage of the permanent hardness from the water, at the same time avoiding the presence of a strongly alkaline solution in the boilers.

Removing Iron Coils from Transformers

While speaking of pitting and deterioration of iron, said Mr. Hunter, an experience which the Union Electric Light & Power Company has been having with cooling coils of high-tension transformers on the hydro-electric system might be mentioned. Careful examination of the iron coils in these transformers showed that they were in a strong magnetic field and were highly magnetized. After being in service for six months it was found that the inside of the coil had deteriorated rapidly, giving the appearance of galvanic action. The pipes had also become heavily coated on the inside with mud deposited by the cooling water. To remedy the difficulty brass pipes have been substituted for the iron, and experience thus far shows that there is no pitting or accumulation of silt.

Mr. Abbott on Condensers

Mr. W. L. Abbott, operating engineer of the Commonwealth Edison Company, Chicago, Ill., in commenting on the growth of the Chicago central-station system during the past twenty years, said that energy is now being generated in the company's stations at a fuel consumption per kilowatt-hour one-half that required twenty years ago. Discussing ways and means for increasing station efficiency, Mr. Abbott suggested the use of shorter boilers operated at greater overloads, utilizing the material saved in boiler construction to build larger economizers. Mr. Abbott believes there is wide field for improvement in the design and construction of more efficient condensers, and in this connection he declared that during the past few years there had been less good judgment displayed in the design of condensers than in any other piece of power-station apparatus. Condenser designers have followed too closely the work of boiler designers, with the result that steam passes through the condensers at high velocities, creating high back-pressures against which the steam-generating unit must operate.

Purchase of Oil Fuel—II

BY R. T. STROHM

One method of determining the percentage of water in oil is to make use of the affinity of petroleum ether for water. A weighed sample of the oil to be tested is placed in a test tube, petroleum ether is added, the two are shaken together and are then allowed to stand. The ether, with the water it has taken up from the oil, will collect on top of the oil and should be decanted into another tube. The remaining oil should again be washed with petroleum ether, the clear solution decanted and added to that in the second tube. A third washing may be performed in the same way.

The water in the oil is removed by these washings, being carried away by the ether. The second test tube is now heated to a temperature of from 100 deg. to 140 deg. Fahr., when the petroleum ether boils and passes off, leaving the water in the bottom of the test tube. The weight of this water, divided by the weight of the original sample of oil and multiplied by 100, gives the percentage of water in the oil.

Another method is to weigh the sample of oil and then to add to it a known weight of plaster of paris that has been gently ignited. The plaster of paris will take up all the water in the oil, after which it should be removed and washed with gasoline to remove all oil. It should then be dried at a gentle heat, to drive off the remaining gasoline, and weighed. The increase of weight represents the water absorbed from the oil. Thus, the weight of the original sample of oil and the weight of the moisture are known, and the percentage of moisture may readily be calculated. A good oil for fuel should not contain more than 2 per cent of water.

Oil should have a specific gravity of from 0.85 to 0.96 at a temperature of 59 deg. Fahr., and should be rejected if its specific gravity is 0.97 or more at that temperature. It should not contain any solid or semi-solid bodies and should flow readily at ordinary temperatures. A good test for fluidity is that the oil shall flow easily through 10 ft. of 4-in. pipe under the pressure due to a head of 1 ft. of oil. It should not freeze or become too sluggish to flow at 32 deg. Fahr. The calorific value should not be less than 18,000 British thermal units per pound. As for cleanness there should be no more than a trace of sand, dirt or clay.

The oil should not contain more than 1 per cent of sulphur. The amount present in the oil may be determined in the following manner: A sample of 50 cc. is put in a flask and 0.5 gram of sodium bicarbonate is added. Heat is applied to the mixture and it is distilled at the rate of about 50 drops per minute until about 45 cc. has been driven off. The residue is then placed in a large porcelain dish and is washed several times with petroleum ether. The ether is collected from the several washings and evaporated. About half a gram of sodium is next added in small pieces, the whole is evaporated over a small flame until it becomes sirupy, and then is ignited. The ignition is continued until the ash is quite white, ammonium nitrate being added gradually during the operation. The residue is treated with very dilute hydrochloric acid and barium chloride is added, precipitating barium sulphate. The precipitate is separated by filtration, washed, ignited and weighed, and the amount of sulphur contained in it is calculated by multiplying its weight by 0.13733. The weight of sulphur divided by the weight of the original sample and multiplied by 100 gives the percentage of sulphur in the oil.

A test may be made with the greatest degree of accuracy, yet it will be of little value in showing the composition of an oil unless the sample that is tested represents properly the whole quantity of oil. Poor methods of taking samples or mistakes in following approved methods may result in unfair and misleading results. For this reason it is very important that the sampling be done correctly.

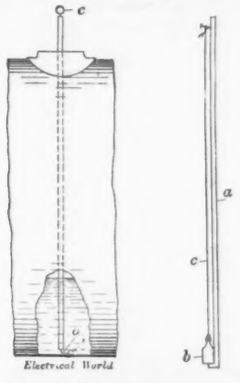
Method of Taking Sample

The manner in which samples are taken depends on the way in which the fuel is delivered. If the oil is brought by tank wagon or tank car and is allowed to flow into the storage tank in such a way that the end of the discharge pipe is accessible, sampling may be done with a dipper holding about a pint. Immediately after the oil begins to flow into the storage tank, the dipper should be filled from the stream of oil escaping at the end of the pipe. The sample thus obtained should be poured into a clean vessel. In the same way other samples should be taken at equal spaces of time during the emptying of the car or wagon. The samples should be taken often enough to give a final combined sample of at least a gallon, and this gallon sample should be thoroughly mixed before any of it is tested for water or sulphur. The dipper used for taking the samples should always be filled to the same point, so that equal amounts will be taken at equal intervals; but if the first dipperful shows water in the oil, it should be thrown away and not poured into the receiving vessel.

In case the end of the discharge pipe cannot be reached for sampling with a dipper, a hole may be tapped in the under side of the pipe and a short piece of ½-in. pipe and a valve attached. Then, during the whole time in which the oil is being discharged, the valve should be left open a fixed amount and a continuous sample of the oil thus collected. This quantity should be thoroughly mixed in a clean vessel and a sample of about a gallon should be taken from it for the tests.

In case the oil is to be sampled in a tank, a piece of 1-in. pipe somewhat longer than the depth of the tank should be used, as shown in Fig. 3. A piece of wire *a* is attached to a tapered wooden plug *b* of sufficient size to close the end of the pipe. The wire is carried through the pipe and has a loop *c* at the upper end. To take the sample, the pipe with the plug hanging below it is slowly lowered vertically into the oil. As it descends the oil rises inside it, and when it has reached the bottom it has inclosed a column of oil from the top to the bottom. The wire is now pulled up, drawing the plug into the lower end of the pipe, where it may be fixed securely by bumping the pipe against the bottom of the tank.

The pipe is now drawn out and emptied into a vessel. The oil thus obtained is a representative sample, because it contains oil from every level between the top



FIGS. 3 AND 4—ARRANGEMENT FOR SAMPLING OIL IN TANKS AND DEVICE FOR TAKING SAMPLES OF OIL

and the bottom of the tank; thus, even if the oil has separated into layers of different specific gravities, the sample includes some of each. Particular care should be taken to lower the pipe slowly, so that the oil will not be stirred up.

If it is deemed advisable to take samples from various parts of a tank instead of just below the manhole, a device like that in Fig. 4 may be used to advantage. It consists of a pole *a*, long enough to reach to any part of the tank, to which is fixed a bottle *b*. To the cork is fastened a string *c* whose other end is attached to the upper end of the pole. To use the sampler, the bottle is cleaned and loosely corked. Then it is lowered by the pole to the point where the sample is to be taken and the cork is removed by a pull on the string. The bottle immediately fills with oil, is drawn out, emptied, and cleaned for the next sampling. In this way samples are taken from various points symmetrically located in the tank. These samples, when mixed thoroughly, form a representative sample.

Sand or earthy matter in oil will eventually settle to the bottom if the oil is allowed to stand for a time undisturbed. Consequently, to determine whether an oil contains dirt, a cup fixed to a long handle may be used to scrape up a sample along the bottom of the tank. If the cupful shows a considerable amount of solid matter, the oil is dirty and may prove troublesome to use.

Induction in Iron Conduit

Three 3-in. iron conduits spaced 8 in. apart are being installed, each to contain three 500,000-circ. mil conductors carrying 440-volt, sixty-cycle, three-phase energy. Will the loss due to induction in the conduit be considerable on a 200-ft. distributing circuit when the conductors are carrying their full load? A. W. L.

You will encounter no difficulty from induction in your three-phase cables if they are inserted in single, iron conduits. At each instant the negative and the positive values of the currents in a balanced three-phase system have a total sum which equals zero, and therefore there is no external inductive action. With three separate iron conduits, each containing the three leads of a three-phase system, there will be no inductive effect between the three separate conduits.

Allowable Outlets on a Branch Circuit

In wiring a factory for 10-watt tungsten lamps, how many outlets should be connected to each branch circuit? G. L. H.

It is allowable to connect a maximum of sixteen sockets (or receptacles) onto one branch circuit provided the total load of these sockets does not exceed 660 watts. By special permission from the inspection department having jurisdiction in cases where No. 14 rubber-covered wire or its equivalent is used with keyless sockets and where there is no chance of small motors, heating devices or lamp clusters being fed from any of the receptacles, it is allowable to connect thirty-two sockets (or receptacles) onto one branch circuit feeding not more than 1320 watts.

Gradual Voltage Drop of Generator When Running at Full Load

We have an old-style revolving-armature, 90-kw, 2200-volt, single-phase generator, which, when started, gives the required voltage at the secondary taps of a step-down transformer, but after operating two or three hours at full load the secondary potential drops from 120 volts to 110 volts. What is the cause of the drop and how can it be prevented? F. T. B.

The decrease in potential across the secondary taps of your transformer may be caused by an excessive temperature rise in the generator or transformer conductors (especially in the field coils), or by a gradual decrease in the power-factor of the load. In a generator of this size a rise in temperature of 60 deg. C. would cause the field current to decrease about 17 per cent. The degree to which the generated voltage will be affected by the decreased field current will depend on the proximity of the field flux density employed to the knee of the magnetization curve. If the cross-section of the armature conductors is restricted enough to produce excessive heating, their increase in resistance will also reduce the useful potential available by increasing the internal drop in the machine. To ascertain whether heating or power-factor is responsible for the voltage drop observe the secondary voltage when the generator is operated at full load first with unity power-factor and then with a low power-factor. If heating is found to be the cause, the equipment will have to be operated at lower than its rated output (unless redesigned), or else a higher rate of heat radiation must be provided. By arranging a blower with its draft directed on the parts subjected to the highest temperature rise, the electrical output may be considerably increased. If low power-factor is the cause of the drop, the potential may be maintained practically constant by floating an over-excited synchronous motor on the line or by replacing some of the inductive apparatus by equipment taking a leading current. Any decrease would be augmented by a lowering of the voltage of the exciter as it became hot.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Armature Circulating Currents in Lap-Wound Multipolars.—C. C. HAWKINS.—Lulofs has shown how in a four-pole machine with lap-wound armature circulating currents partially compensate for unequal pole-strengths. His further conclusion that the same action is not present with six or eight poles is here brought in question, and it is shown that the same principle holds in all multipolar machines with lap-wound armatures. The article is profusely illustrated by diagrams. —London *Electrician*, March 6, 1914.

Lamps and Lighting

Metallic-Filament Lamp.—A description of a new metallic-filament lamp, the feature of which is the peculiar arrangement of the filament, as shown in Fig. 1,

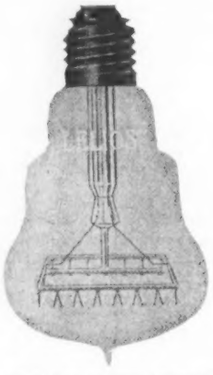


FIG. 1—METALLIC-FILAMENT LAMP

giving a horizontal illuminating surface. The lamp is especially useful for table lighting and for purposes in which the horizontal illumination should be a maximum.

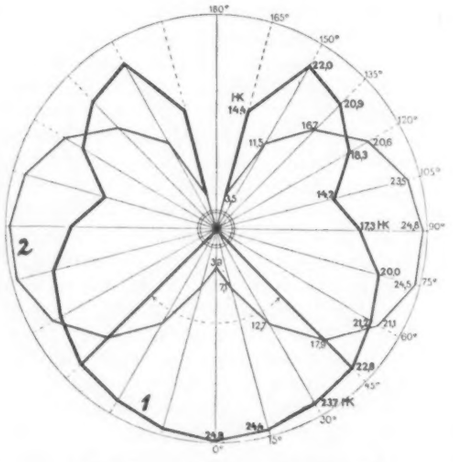


FIG. 2—DISTRIBUTION CURVE

In Fig. 2 curve 1 gives the candle-power distribution from such a lamp, and curve 2 gives the candle-power distribution from an ordinary metallic-filament lamp.—*Elek. Zeit.*, Feb. 26, 1914.

Malleable Tungsten.—A note on a recent British patent (No. 5150, 1913) of J. Canello. The finely divided metal is mixed with a small quantity of nickel, and with glycerine to act as a binding agent. The mixture is then compressed, slowly dried, and afterward sintered in an electric furnace.—London *Elec. Eng'ing*, March 5, 1913.

"Marble Light."—W. VOEGE.—An illustrated article on the so-called "marble light," the characteristic feature of which is the use of translucent marble plates instead of the usual white glass in illumination fittings. It has long been known that marble in very thin layers is translucent and that very pretty light effects can be obtained especially with thin colored marble layers. But the high expense of grinding thin layers has prevented their extended use. According to a recent process of H. W. Engel, marble plates of 3 mm to 20 mm (⅛ in. to 25/32 in.) thickness can be made translucent by a special grinding and impregnating process so that they are superior in translucency to white-glass plates of normal thickness. In this process the marble plates are first ground on both sides and are then impregnated at high pressures and temperatures with oils of different kinds. This new process is much less expensive than the manufacture of thin plates of a few tenths of a millimeter in thickness. The thick marble plates are naturally also very strong. Colored marble plates of this thickness give beautiful light effects which cannot be imitated at all by means of colored glass. On some of the German transatlantic steamers skylights are used consisting of colored marble plates illuminated by electric incandescent lamps. In the present article the author deals very simply with the use of white marble in place of white glass. He first gives results of tests of the translucency and diffusion capacity of impregnated marble and white glass for rays within the visible spectrum. One of the tests was as follows: The author's laboratory is usually illuminated by three 25-cp clear-bulb tantalum lamps and six 25-cp frosted tantalum lamps. The illumination obtained thereby is on the average 25.6 lux, the maximum being 70 lux and the minimum 6 lux. The specific consumption with these tantalum lamps is 0.43 watt per lux per square meter. For nine tungsten lamps arranged in the same way the specific consumption would be 0.31 watt per lux per square meter. In a second and third test these line-distributed lamps were replaced by a single high-candle-power metallic-filament lamp, diffusion of the light being obtained by means of white glass or white marble. In both cases a 330-watt, 400-cp osram lamp was used. With white glass the illumination was 20 lux on the average, the maximum being 36 lux and the minimum 10 lux, and the specific consumption 0.43 watt per lux per sq. m. With white marble the illumination was 27.7 lux on the average, the maximum being 55 lux and the minimum 11 lux, and the specific consumption 0.34 watt per lux per sq. m. The results show that the use of a single high-candle-power metallic-filament lamp with white marble gives about the same specific consumption as nine distributed osram lamps, while the uniformity of illumination is very much better with the marble (55 to 11, against 70 to 6). With white

glass this uniformity is also satisfactory, but the specific consumption is higher. Other tests also show that marble plates are more translucent than any other absorbing media. A pure white light is obtained while any irritating effect is avoided. All observers agree that the "marble light" appeared to be particularly agreeable to the eye. The author tried to find a reason for this. No difference could be found between marble and white glass as to translucency for ultra-violet rays. The only difference between marble and white glass is that if the two media permit the same amount of light to pass through, marble absorbs the dark heat rays to a much greater degree than any other medium, and it is thought that this fact explains the beneficial physiological effect. Where indirect or semi-indirect illumination is impracticable, the author thinks that the use of white marble gives the most agreeable light at present. —*Elek. Zeit.*, Feb. 19, 1914.

"Cathode Incandescent Lamps."—H. GREINACHER.—When an electric discharge passes between two electrodes in a vacuum tube (Geissler tube) the cathode is strongly heated while the heating of the anode is small. In cathode tubes it is important to avoid this heating of the cathode, which is, therefore, made of large mass and surface. In the present instance, however, the author has endeavored to utilize this same effect as a source of light. For demonstration purposes the arrangement of Fig. 3 may be used. Two carbon lamps or metallic-filament lamps are connected together through a glass tube, and the whole, consisting of the two globes and the connecting glass tube, is evacuated. After the terminals of an induction apparatus are connected to the two lamps, a discharge passes from one lamp to the other lamp. It will be found that the lamp connected with the negative pole becomes incandescent while the other lamp remains dark. By using a sufficiently strong secondary current (employing an induction apparatus with Wehnelt interrupter) the lamp connected with the negative pole becomes lighted as though it were used under ordinary conditions. This arrangement is useful for producing very pretty luminescence effects, but the cathode soon disintegrates and the globe blackens so that this arrangement cannot be used for practical purposes. For practical applications the author suggests the arrangement shown in Fig. 4, the material of the Nernst-lamp filament being employed. Nernst filaments *S* are inserted in quartz tubes *Q* in a glass globe with attached tubes *R* which may be evacuated from *A* as shown in the illustration. Connection of the Nernst filaments with the outside circuit is made through platinum wires *Pt*. If a vacuum of a few millimeters of mercury traversed by a 1000-volt alternating current, a blue brush discharge is emitted from the filaments *S*. These are thereby heated until they get white hot. The starting of the lamp takes only a few seconds. The new lamps can be made in a very simple manner. A high-vacuum pump is not required. It even seems better not to push the vacuum too far. "With 820 volts between the filaments the current measured was 0.11 amp so that the power consumption was 90 watts. The lamp was at least as bright as a 50-cp incandescent lamp." The author questions whether the cathode incandescent lamp would be useful for all purposes or only for cases where direct connection to a high-voltage circuit is desirable.—*Elek. Zeit.*, March 5, 1914.

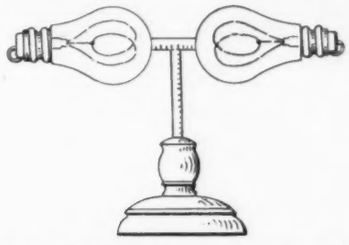


FIG. 3—ARRANGEMENT OF LAMPS

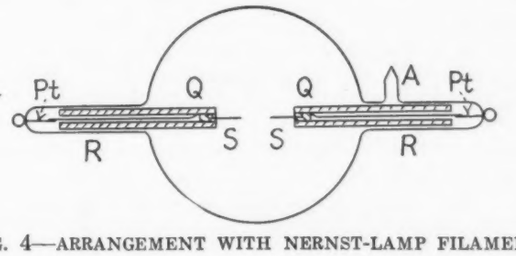


FIG. 4—ARRANGEMENT WITH NERNST-LAMP FILAMENT

Generation, Transmission and Distribution

Transmission Lines.—ULISSE DEL BUONO.—An extensive paper read before the Italian Electrical Engineering Association on the calculation and testing of long-distance transmission lines. The author gives a very simple and rapid method for calculating the regulation, energy losses, etc., in overhead lines and gives a report of tests made on the line from Pescara to Naples which has a length of 185 km (111 miles) and is operated at 90,000 volts. These tests related to the regulation at different loads. The line capacity, inductance, corona losses, etc., were also measured. The results show a very close agreement between measurements and calculations. The paper contains numerous diagrams.—*Assoc. Elettrotecnica Italiana*, Vol. 17, Oct. 31, 1913.

Connections of Three-Phase Transformers. — R. SWYNGEDAUW.—The magnetic flux produced by a sinusoidal current in the core of a transformer is not itself sinusoidal if the iron is saturated. The third harmonic in the flux wave is the more pronounced the higher the saturation of the iron. The author studies the influence of this harmonic on the liability of producing dangerous high voltages in three-phase lines supplied from the transformers. He concludes that the danger of such rises of voltage disappears if the third harmonics are prevented from entering into the line by means of connecting in delta the secondary winding of the transformer at the transmitting station and the primary winding at the receiving station—*Comptes Rendus*, Vol. 158, page 484; abstracted in *La Revue Elec.*, March 6, 1914.

Three-Phase Transmission.—A. BLONDEL.—A paper on the influence of the method of connecting the transformer windings on three-phase transformer systems. In order to protect the transmission system against the effect of the third harmonics two remedies may be employed. The first is the use of transformers or groups of transformers in the transmitting as well as receiving stations with their low-tension circuits connected in delta and their high-tension circuits connected in star. The second remedy is the use of a metallic insulated "equilibrium wire" connecting the neutral points of the high-tension windings of the transmitting and the receiving stations.—*Comptes Rendus*, Feb. 16, 1914; abstracted in *La Revue Elec.*, March 6, 1914.

Hoisting Plants.—WILFRED SYKES.—An article illustrated by diagrams on the power requirements of electric hoisting plants.—*Elec. Journal*, March, 1914.

Traction

Stockholm Suburban Road.—F. F. SON HOLMGREN.—The conclusion of his illustrated article on the electrification of the suburban road from Stockholm to Saltsjobaden in Sweden. In the present instalment details

are given of the line construction and of the motor-generator station where the three-phase currents are changed to 1350-volt direct current. Some notes are given on the results obtained since the line was opened in May, 1913, and on the way in which some initial difficulties were overcome.—*Elek. Zeit.*, March 5, 1914.

Electrification of Railways.—E. de Marchena.—A report on the present situation in the electrification of railways with special reference to France.—*La Houille Blanche*, Jan. 1, 1914.

Petrol-Electric Motor Cars.—A brief illustrated article on the use of petrol-electric motor cars on the Swedish railways.—*La Lumière Elec.*, March 7, 1914.

Installations, Systems and Appliances

Paper and Pulp Industry.—E. C. Morse.—An illustrated article on the use of electric motors in the pulp and paper industry, with tables giving the typical electric-drive equipment for different machines.—*Elec. Journal*, March, 1914.

Units, Measurements and Instruments

Measuring the Resistance of a Ground.—M. Lasalle.—Usually the resistance of a ground connection is determined by Kohlrausch's bridge method with a telephone. The method supposes that three grounds x, y and z are available. The values $x+y$, $x+z$, and $y+z$ are determined in succession so that one gets the equations from which the values of the three resistances can be calculated. The connections for determining the value of $x+y$ are shown in Fig. 5. When silence is

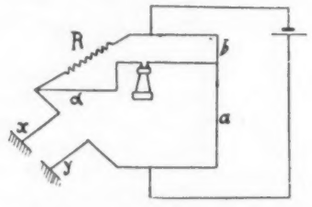


FIG. 5—DIAGRAM OF CONNECTIONS FOR DETERMINING RESISTANCE OF GROUNDS

obtained in the telephone we have $b\,(x+y) = aR$, where a and b form together the contact wire along which a contact slides. In an analogous way the values $x+z$ and $y+z$ are determined. The author points out that this method has several inconveniences and may be advantageously replaced by the following method. The value $x+y$ is determined as described above, but then the connections are changed to those of

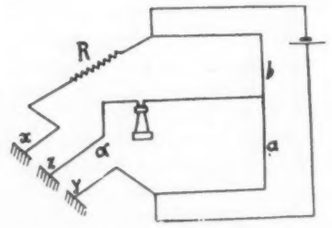


FIG. 6—DIAGRAM OF CONNECTIONS FOR DETERMINING RESISTANCE OF GROUNDS

Fig. 6. All that is to be done for this purpose is to change the connection of the telephone from the ground x to the third ground z. When silence is obtained in the telephone we have $by = a\,(R+x)$. We have, therefore, two equations for the two unknown values x and y. This method is, therefore, simpler and requires less calculation than the former method. It is also more accurate.—*Assoc. des Ingen. Elec. Inst. Electrotec. Montefiore*, November, 1913.

Testing Work of a Power Company.—T. F. Whimster.—An illustrated paper on the electric testing work of a large power company. The author discusses the initial examination and adjustment and the maintenance of all electric protective apparatus, such as feeder and transformer protective gear, and the initial and routine testing and repairs of all electricity meters and all measuring instruments. He then takes up what may be called special testing work, such as efficiency and temperature tests of generators and transformers, etc., further electric tests of samples of materials such as tapes, insulators, oils, etc., and the use of the oscillograph. The paper is concluded by a chapter on standards and sub-standards. In an appendix several special problems are discussed, including a method of ascertaining the correct connection of three-phase meters, temperature tests of generators, etc.—*Transac. South African Inst. Elec. Eng.*, December, 1913.

Measuring Transformers.—E. Alberti and V. Vieweg.—An account of an investigation carried out in the Reichsanstalt on the experimental determination of the magnetizing current of a measuring transformer. Two methods were tested and compared. In the first method a determination is made of the transformation ratio and the phase difference between primary and secondary currents by means of a compensation method with the vibration galvanometer as zero instrument. In the second method the "magnetic voltage meter" (Spannungsmesser) is employed. This is the coil of uniform cross-section with uniformly distributed winding. In a magnetic alternating field the emf induced in this coil between its terminals is proportional to the magnetic tension between its terminals measured along its axis. Hence if the "magnetic voltage meter" embraces a number of windings through which the same current flows, the voltage of the magnetic meter is proportional to the embraced ampere windings, but lagging in phase by 90 deg. If the magnetic voltage meter is therefore placed simultaneously through the primary and secondary coils of a transformer, the emf of the magnetic voltage meter is proportional to the geometric difference of the primary and secondary ampere-turns. Both methods were applied to the test of a measuring transformer for 10 amp to 5 amp, and the results obtained with both methods are compared in the form of diagrams. These show certain differences which are explained by the effect of the wave-form of the magnetizing current on the measurement with the magnetic voltage meter.—*Archiv. f. Elek.*, Vol. II, 1913, No. 5.

Electrolytic Valves.—G. Schulze and R. Lindemann.—Zenneck has found that the rectifying effect of electrolytic valves decreases with increasing frequency. The present authors show that this is due to the electrostatic capacity and the critical tension of these valves. This is proved experimentally by the substitution of a mercury rectifier in parallel with a condenser for the electrolytic valve. The results of the experiments agree with the theory.—*Phys. Zeit.*, March 1, 1914.

String Electrometer.—Theo. Wulf.—An illustrated description of a string electrometer, the feature of which is the elastic method of fastening the lower end of the string whereby advantages are obtained with respect to sensitiveness and ease of transportation.—*Phys. Zeit.*, March 1, 1914.

Wires, Wiring and Conduits

Calculation of Lines.—J. Desplanques.—A mathematical article on a simple method of calculating a transmission line with respect to variation of temperature, change of wind pressure, variation of distance between poles, variation of slag, effect of a rupture on the line, etc.—*Assoc. des Ing. Elec. Inst. Electrotec. Montefiore*, November, 1913.

Insulating Conductors.—A note on a recent British patent (No. 18,517, 1913) of J. A. Heany. Fibrous insulation, such as asbestos, is applied to conductors as a smooth uniform sheath. This is effected by covering a thread or filamentary body with a coating of the fibers, using an adhesive binder, winding this on the conductor, and finally smoothing.—London *Electrical Eng'ing*, March 5, 1914.

Electrophysics and Magnetism

Natural and Artificial Electrification of the Atmosphere.—SIR OLIVER LODGE.—His Kelvin lecture, in which the measurement and causes of the electrification of the atmosphere and its relation to the weather are discussed. The author then deals with artificial electrification and the application of electricity to agriculture, and makes suggestions as to researches needed in this direction and the possibilities of weather control.—London *Elec. Eng'ing*, March 6, 1914.

Effect of Electric and Magnetic Fields on Spectral Lines.—N. BOHR.—In a previous paper the author had shown that an explanation of some of the laws of line spectra may be obtained by applying Planck's theory of black radiation to Rutherford's theory of the structure of atoms. In the present paper these considerations are further developed, and it is shown that it seems possible on the theory to account for some of the characteristic features of the recent discovery by Stark of the effect of an electric field on spectral lines, as well as of the effect of a magnetic field first discovered by Zeeman. It is also shown that the theory seems to offer an explanation of the appearance of ordinary double spectral lines.—*Philos. Mag.*, March, 1914.

Book Reviews

ALTERNATING CURRENTS AND ALTERNATING-CURRENT MACHINERY. By D. C. and J. P. Jackson. New York, N. Y.: The Macmillan Company. 968 pages, illus. Price, $5.50.

This being a new edition of a well-known work, it should not be necessary to give a summary of its contents, or to venture a judgment on its merits, except in so far as the present edition differs from previous issues. The book was first published in 1896, and the appearance of this new edition, rewritten and enlarged, suggests that it has met with a favorable reception. The additions include a more thorough treatment of transient phenomena, vectors, complex quantities and Fourier's series, hysteresis and eddy-current losses in laminated cores, and the treatment of the electrostatic capacity of transmission lines, together with the effects of distributed inductance and capacity.

The whole field of alternating currents and their application in single-phase and polyphase machinery is covered in a thorough and masterly manner. The book is written for teachers and students in engineering schools. It is primarily a textbook, but the authors believe it will also prove of service as a reference book for those engaged in practical work. This belief may be well founded, and so voluminous a record of persistent labor and clear thinking deserves to have an important place outside of the schools; but it is possible that the engineer engaged in practical alternating-current work may find other books—less comprehensive perhaps, and less thorough—that will yet more nearly satisfy his particular needs. For the practical man, who requires a clear conception of the reasons of things as the surest means of reaching the desired end, a mathematical viewpoint is not always the best. The authors claim that every effort has been made to present a full physical conception of phenomena to the reader's mind. "The mathematics used are merely logical means for accomplishing the end," but it is unfortunately a logic which can be followed only by those well versed in mathematical methods. The authors, being themselves thoroughly familiar with the uses of mathematics as a convenient means of attaining their results, tend perhaps to place too much confidence in this tool. We do not suggest that it leads them into error or perverts the facts, but merely that it keeps them out of touch with those who would prefer more natural methods of presentation. It does not seem altogether impossible that graphical or semi-graphical methods of solving alternating-current problems may come into favor with practical engineers.

The mathematical—or perhaps more properly the academic—standpoint is taken by the authors when treating of self-induction, and the definition given on page 128 seems unnecessarily involved. To many engineers the self-induction of a circuit is merely the induction due to a current in the circuit; it has no peculiar or mystic properties which it does not share with other inductions. The symbolic treatment of problems involving inductive reactance tends somewhat toward obscurity of conception in the minds of students not mathematically inclined, but if they once clearly picture the flux of self-induction linking with the turns in the electric circuit, and connect this picture with the word "inductance," the path of progress instantly becomes smoother. Many a student has the haziest ideas on the subject of self or mutual induction, and this is perhaps not always the fault of the student. From the teacher's point of view, the book has much in its favor. Its completeness renders frequent reference to other works unnecessary; but, at the risk of seeming to criticise adversely, it might be asked whether so much material should be included, and so much ground covered in so complete a manner, in a single treatise. In this connection it is only fair to state that the authors themselves consider the book as a whole too long for the courses in many engineering schools, and they recommend that certain chapters be selected to suit the requirements of individual schools.

THE RESISTANCE OF THE AIR. Aviation experiments conducted at the Champ de Mars laboratory by G. Eiffel. New York: Houghton, Mifflin Company. Price, $10.

In 1891 Professor Langley published his book upon aerodynamics. This classic book showed the way to the proper development of the science of flight. Yet so slowly did the ideas and methods of Langley get recognition that twenty years passed before the science of aeronautics had any firm foundation, although the art was developed ten years after Langley's work was published. To Gustave Eiffel more than to any other man we owe the fact that to-day engineers can obtain aeronautical data based upon thorough laboratory experiments. The book before us is the complete record of laboratory experiments in three different departments of aerodynamics. It shows the four characteristics of the resultant pressure upon a great variety of supporting surfaces arranged as monoplane, biplane and tandem. These four characteristics of the resultant air pressure are direction, line of action, point of application and magnitude, and all must be known if one is not to work blindly. The resistances of struts, wires and other non-supporting surfaces are recorded, as is also the efficiency of propellers. From this book alone it is possible to construct a machine and to know beforehand just what it will do. The translation is a very good one, the press work is exceptionally fine, the graphs are very clear, and the type is large and distinct.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Cartridge-Fuse Attachment Plugs

Attachment plugs made of both porcelain and composition material for 6-amp cartridge fuses are shown herewith. The fuse used with the plug measures 13/32 in. in diameter and 1.5 in. over all. These plugs are designed particularly for use with electrically operated portable machines such as drills, grinders, etc. The composition plug is intended for installations subject to hard usage. These attachment plugs are being placed on the market by Harvey Hubbell, Inc., Bridgeport, Conn.

FIGS. 1 AND 2—ATTACHMENT PLUGS FOR CARTRIDGE FUSES

Portable Laboratory Meter

A portable laboratory meter of the D'Arsonval type is shown herewith. A single air-gap is employed, and through this swings the moving coil, which is pivoted at one edge. The moving parts can be taken out for inspection or repairs without disturbing the magnetic circuit. The light metal frame on which the moving coil is wound moves through the air-gap of the magnets and makes the reading inherently dead-beat.

LABORATORY METER

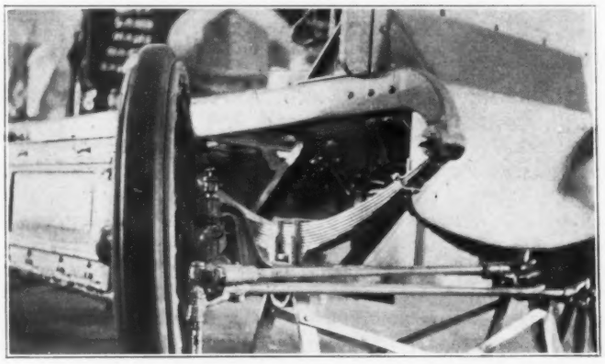
The scale, which is 11.5 in. long, subtends an arc of 100 deg., giving large open divisions which are of uniform length throughout. The scale has diagonal markings which facilitate accurate readings of fractions of divisions. A mirror extending the entire length of the scale is used to prevent parallax in reading.

For use with the millivolt meters combination laboratory portable shunts are supplied. These combination shunts include three shunts of any desired rating up to 200 amp, mounted in a single box with suitable terminals. This meter is furnished as a voltmeter or as a millivoltmeter. The millivoltmeter can be used as an ammeter when high accuracy is desired.

The instrument is mounted in a polished-walnut carrying case which is equipped with removable hinged covers. The Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., is placing this meter on the market.

Electric Trucks at Boston Commerical Motor Vehicle Show

At the third annual commercial motor-vehicle show, held last week in Boston, Mass., the Buffalo Electric Vehicle Company, Buffalo, N. Y., exhibited a 2000-lb. chassis and running gear with a new feature in the shape of a foot control by means of which the brakes cannot be applied without cutting off the supply of energy to the motor. An extra controller and resistance for operation by the chauffeur's pedal are provided under the front platform, and the manufacturers contend that a saving of from 15 to 20 per cent in energy consumption for a given ton-mileage results, giving correspondingly increased operating distances per battery charge. The advantage to the driver of being able to retain the hold of both hands on the steering wheel on rough roads is important, and the builders emphasize the tendency toward increased energy consumption in equipments in which it is necessary to let go with one hand in order to shut off the power. The machine exhibited had another new feature in the shape of a battery box equipped with a folding lid which can be used as a table in withdrawing the cells, the lid being fastened to the box proper by pull spring hooks instead of the usual troublesome wing nuts. On the truck shown the braking surface totaled 500 sq. in., and the rear tires were 5 in. wide against an average of 4 in. for



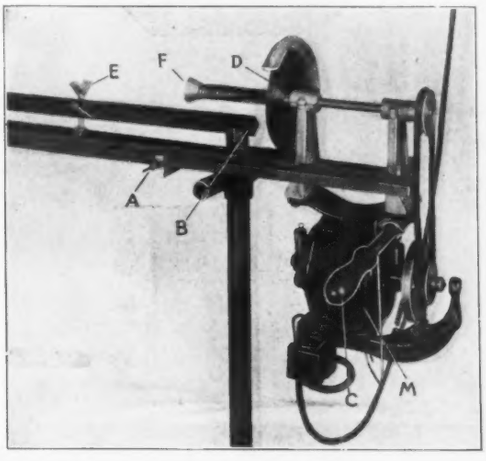
ONE-TON TRUCK WITH LONG SPRING

this size of machine. The motor was supported on trunnions without the use of a universal joint, and the springs were 42 in. long, compared with a common length of 36 in. The truck was equipped with forty-four cells of Philadelphia WT-15 battery and an 85-volt, 22-amp General Electric motor.

The General Motors Truck Company's exhibit included two electric trucks of 4000-lb. and 1000-lb. capacity. The company has recently sold a 12,000-lb. electric truck to the Roxbury (Mass.) Iron Works for heavy haulage in the Boston district. This is said to be the largest electric truck thus far sold in New England. It will be equipped with a twenty-nine-plate Philadelphia battery and a standard "C" chassis. Eight 1-ton electric delivery wagons have been sold to the Animated Advertising Company, of Boston, Mass., which is equipping these vehicles for combined delivery and animated electric-sign advertising of a well-known brand of tobacco. Other products are to be featured in the same way in both Europe and America.

Shade-Roller Measuring, Sawing and Boring Machine

A motor-driven machine which is designed to saw and bore shade rollers, and which can be set to measure for various styles of brackets, is shown herewith.



MOTOR-DRIVEN MACHINE FOR MEASURING, SAWING AND BORING SHADE ROLLERS

The saw operates on the swing-saw principle, the motor hanging below and balancing the saw. When the handle of the machine is moved, the current is automatically turned on, the motor then starts and the saw swings forward. After cutting the end of the roller a hole is drilled in the center of the roller by pressing it in the cone which surrounds the drill and which automatically centers the roller. The drill is in the center of the cone and is supported by a spring. This spring is pushed back while the drill is engaged in boring.

By referring to the illustration the detailed operation of the machine is as follows: The rollers are placed in the trough *B*, the lever *C* is turned slightly to the left, thereby starting the motor *M*, and the lever *C* is then pressed down as a result, bringing the saw *D* across the rollers and sawing them square. The sawing operation requires about one second. The rollers are now placed in the crotch *E* and the ends are inserted in the tapered cup *F*, which centers the rollers. Now on starting the motor by turning the lever *C* slightly to the left each roller is bored for the pin.

The machine occupies a space of 2 ft. by 6 ft., and it is manufactured by Messrs. Mylod & Sons, Providence, R. I. The motor used in its operation is made by the Diehl Manufacturing Company, Elizabeth, N. J.

Electric Cooking Appliances

An electric range and toaster are being placed on the market by the Rutenber Electric Company, Logansport, Ind. The range is made of heavy metal and is well

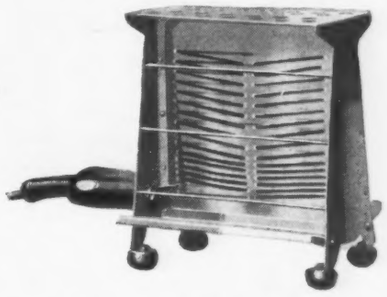


FIG. 1—ELECTRIC HEATER

finished. The oven interior is of sheet aluminum, and insulating material 2 in. thick is placed between its inner and outer walls. The switches are placed at an angle of 30 deg., thus enabling the operator to read the lettering on the indicating dials more readily.

The toaster is made of stamped steel and is finished with highly polished nickel. Six feet of silk heater

FIG. 2—ELECTRIC RANGE

cord and a separable attachment plug are furnished with the toaster. This attachment plug is made in the shape of a handle and may be used to carry the toaster about from place to place.

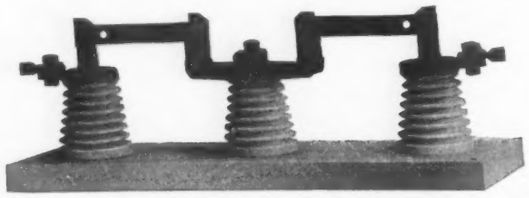
In Fig. 1 is shown the electric toaster and in Fig. 2 the electric range.

Selector-Type Disconnecting Switches

The selector type of disconnecting switch is a transfer switch using a circuit which does not need be opened while a change is being made. The switch can also be used to connect two independent circuits in parallel. These devices are in effect two single-throw, single-pole disconnecting switches with the hinge jaws

connected together and mounted on the same insulator. The hinge jaw is also provided with dummy jaws to hold either blade of the switch in the open position.

These switches, which are made in two types, are being placed on the market by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. The type M switch is designed for wall mounting, the live parts being carried on porcelain insulators fastened to a cast-iron yoke or base. All parts of this switch excepting the porcelain insulators are finished in black marine. The type D switch is designed for indoor mounting on marble bases or switchboard panels. It



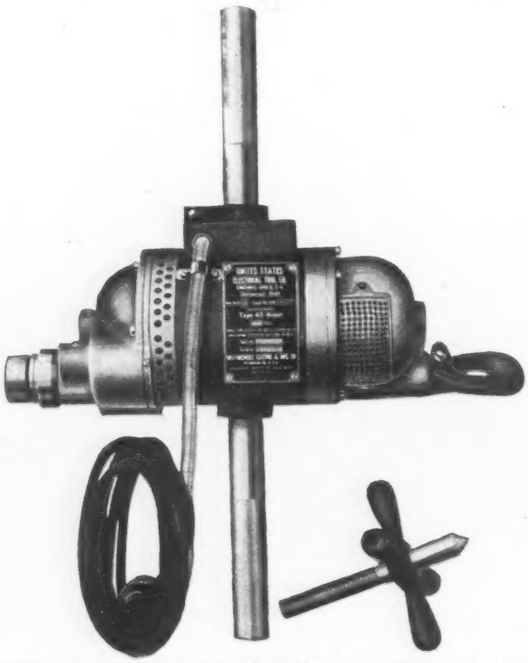
SELECTOR-TYPE DISCONNECTING SWITCH WITH BOTH SIDES CLOSED

is made for either front or rear connection or for any combination of front and rear connections desired. The copper parts are dipped and lacquered.

Electric Drill

The electric drill illustrated herewith is manufactured by the United States Electrical Tool Company, Cincinnati, Ohio, and a Westinghouse motor is used to drive the device. The motor is series-wound and will operate on either 110 volts or 220 volts, direct current, or 110 or 220 volts, sixty cycles or less, alternating current.

The drills are designed for either wood boring or metal drilling. Each drill is fitted with a magnetic



ELECTRIC DRILL FOR WOOD BORING AND METAL DRILLING

blow-out switch, and the casing of the motor is made entirely of aluminum. The gears are made of hardened chrome-nickel steel, and they run in grease.

The drills are manufactured in the following sizes, 3/16 in., ¼ in., 5/16 in., ⅜ in., ½ in. and ⅞ in.

Push-Button Switch

The push-button switch illustrated in Fig. 1 is made by the Connecticut Electric Manufacturing Company, Bridgeport, Conn. The switch is equipped with a posi-

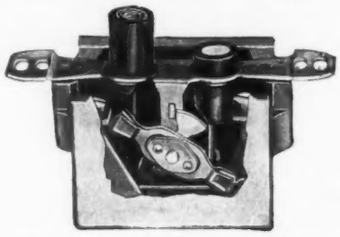


FIG. 1—PUSH-BUTTON SWITCH

tive lock and a quick-break mechanism and is inclosed in a porcelain receptacle. The box furnished with this switch is shown in Fig. 2. One of the sides of the box is removable, enabling any number of gangs to be built up. The bottom of the box is provided with four plugs

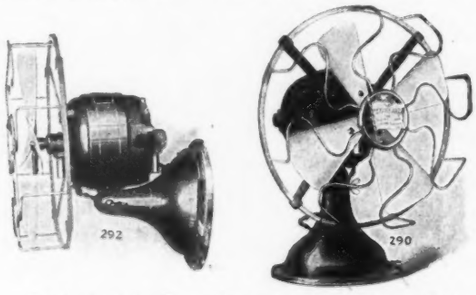
FIG. 2—SWITCHBOX

which can be knocked out in case it is desired to have leads enter the box from below. One of the sides opposite the removable side also has a plug. No spacers are required with this box.

Eight-Inch Desk Fan

An 8-in. direct-current desk and bracket fan is being placed on the market by the Robbins & Myers Company, Springfield, Ohio. This fan is designed for both 110-volt and 220-volt direct-current circuits. By means of a speed-regulating coil and switch in the base, speeds of 1700 r.p.m., 1400 r.p.m. and 1000 r.p.m. can be obtained. At these speeds the motor takes 25, 20 and 15 watts respectively.

A hinge joint provides for trunnion adjustment, adapting the fan for either desk or bracket service. The blades are made of sheet brass and are riveted to a punched carrier which is formed to give a uniform

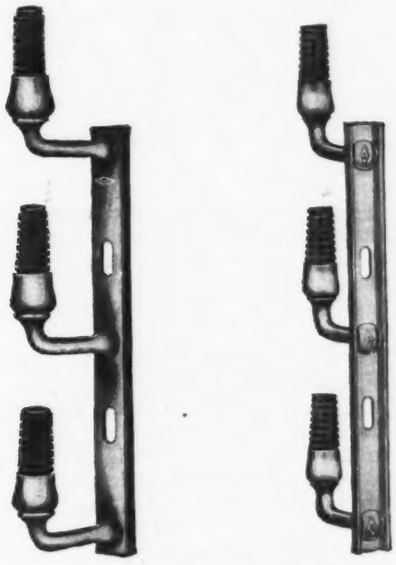


FIGS. 1 AND 2—DESK AND BRACKET FANS

pitch to all blades. A strong guard surrounds the blades and is fastened to the body by four steel supports. The frame and base of the motor are finished in baked black enamel with gilt stripes. The blades have a brushed-brass finish and are lacquered.

Bracket Hardware

The impregnated locust or oak cobs used in the construction of the brackets illustrated herewith are slowly forced into the cold-drawn steel shells under a pressure of several tons. A desirable wood thimble is thus secured without the danger of the cobs splitting. The wall plates are made of pressed-steel and open-hearth

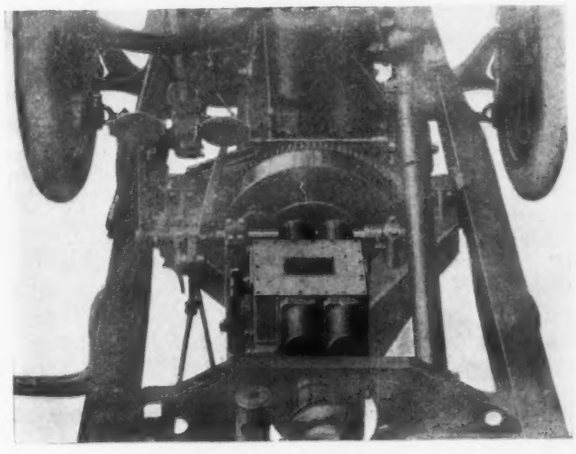


FIGS. 1 AND 2—FRONT AND REAR VIEWS, SHOWING METHOD OF ELECTRIC RIVETING

channels and the brackets of hot-forged open-hearth steel. The brackets are riveted hot with electrically operated riveters. No metal portion of the bracket touches the insulator. These brackets are the product of the Barnes & Kobert Manufacturing Company, New Haven, Conn.

Electric Gear Shift for Automobiles

An electric gear shift which was formerly manufactured by the Vulcan Motor Devices Company, Philadel-



ELECTRIC GEAR SHIFT

phia, Pa., and which is now made and marketed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., is shown in the accompanying illlustration. Instead of employing a hand-operated lever to shift the gears, power for this work is supplied by a solenoid which is capable of exercising a pull of 150 lb. In the Vulcan system four such solenoids, which are mounted under the car, control respectively the high, low and intermediate forward speeds and the reverse speed. These solenoids are energized by a battery and are controlled from push-buttons mounted on the hub of the steering wheel, the forward speed buttons being marked 1, 2 and 3 (for first, second and third speed) and the reverse speed button bearing the letter R.

When one of the speed-changing buttons is depressed the circuit to the proper gear-shifting solenoid is partly closed, but the actual closing of the circuit is not completed until the clutch pedal is thrown in. This pedal carries a small master switch which completes the circuit to the battery. Very little energy is used as none is consumed except at the instant the gear shifting solenoid is energized.

The principal advantages claimed for this electric gear shift are:

(1) Ease of operation.

(2) The device can be operated without removing the hand from the steering wheel or taking the eye from the road ahead.

(3) The gears can be shifted very quickly.

(4) The driver is enabled to anticipate speed changes without actually changing the speed until ready.

(5) The clutch is always fully disengaged and the gears are always drawn mechanically to the neutral position before a shift is made, thus rendering it impossible to strip a gear.

Changeable-Letter Electric Window Signs

Changeable-letter electric window signs of the type illustrated by the accompanying picture are made by the Brilliant Sign Company, 420 North Eighth Street, St. Louis. As shown in the illustration, three sizes are made containing respectively twenty-one, fourteen and ten letters, the blank spaces between letters being counted as letters. The frames containing the letters are of oxidized bronze, oxidized copper or polished brass. The letter panels, which are removable, are shaded blue glass, the letters themselves being in opal white. Ten-watt tungsten lamps are placed behind the letter panels, so that one lamp serves to illuminate several letters. Thus, six lamps are required for the twenty-one-letter sign, four for the fourteen-letter sign, and three for the ten-letter sign. A flasher is fur-

CHANGEABLE-LETTER ELECTRIC WINDOW SIGN

nished to flash the light from the lamps. The price of these signs is moderate and includes one set of letters to fill the sign, the necessary number of lamps connected, the flasher and an attachment cord 8 ft. long with plug. Additional letters to change signs may be had.

Jobber, Dealer and Contractor

Electrical Section at Women's Exposition in Cleveland

Electric lamp and appliance manufacturers, contractors and dealers were liberal contributors to the success of the Women's Exposition recently held at the Central Armory, Cleveland, Ohio. The entire center row of booths, surmounted by lighting units in diffusing globes, was given over to the electrical concerns to exhibit electrical devices for the home. Booths at the sides of the electrical exhibits were occupied by general household displays. However, the fact that more than one-third of the available exhibit space was taken by electrical interests indicates what a large part electricity is beginning to play in the home life of the average family. Furthermore, as the woman is the real purchaser of household equipment, it would seem that the electrical concerns were not far wrong in spending their time and money on exhibits at such an exposition.

Legislation Affecting Electrical Contractors

The committee on legislation of the National Electrical Contractors' Association, of which Mr. Paul H. Jaehnig, of Newark, is chairman, has gathered a large quantity of data on existing and proposed legislation bearing on electric work, so as to be in a position to suggest ways and means of accomplishing results based on the experience of those who have succeeded in having satisfactory legislation enacted. It is the hope of the committee that as soon as its data are completed it can submit a model state law and city ordinance that will be applicable in all essentials to every state and city in the United States. The committee suggests that each electrical contractor take a personal interest in the subject and secure the co-operation of all the electrical interests, principally the lighting company, the labor organizations, the municipal and underwriters' inspection bureaus, manufacturers, jobbers, electrical engineers, architects and, in fact, all who are directly or indirectly interested in safe electrical work.

For the guidance of electrical contractors, the committee states that any law drawn in their interests should embody certain essential features. The law should be obviously designed to protect life and property. It should not create a monopoly for the electrical contractor but should be so framed as not to restrict the freedom of those who wish to engage in the business. A competent lawyer should be consulted in the matter so that there will be no doubt as to the constitutionality of the act after its passage. A competent examining board should be provided for and the license fee should be small. Violations of the law should be made a misdemeanor. The public and legislators should be educated on the necessity and justice of the law and the protection it affords. The electrical contracting business should be dignified by having it legally recognized, so that the term "electrical contractor" will carry with it the prestige it deserves. No provision should be made for a bond as a penalty is sufficient to safeguard the public, but licenses should be made revocable with violations. Workmen should not be licensed; the responsibility should rest entirely with the master electrician.

The committee points out that the licensing of electrical contractors is at present receiving much attention throughout the country, as it seems to be the only solution of certain abuses and weaknesses in the trade. One of the chief difficulties in obtaining uniformly good results in electrical construction work is the irresponsible contractor, who through lack of knowledge of correct principles, the use of inferior material and poor workmanship tends to create a life and fire hazard instead of a safe installation. This has a tendency to discredit the business in general, and more particularly the legitimate and well-qualified contractor who strives always to install his work in accordance with correct principles and to produce a safe and creditable installation.

A license in itself would not be an assurance of safe or honest work, according to the committee, but merely indicates that the licensee is in a degree competent. It would prevent from engaging, much less staying in the business those who do not possess the requisite knowledge of the correct principles and their practical application. The cancellation of a license for cause would be more effective than the fear of a suit under a bond. A license tends to dignify the business, gives it official recognition and places it on a higher plane in the minds of the public. It tends to fix responsibility and guarantee a compliance with the requirements of the National Electrical Code.

Laws governing electrical contracting are at present in force in Tennessee, Louisiana, Maryland, Minnesota, Ohio and the District of Columbia. In general these laws provide for a license to do electrical work, which can be secured by passing an examination before an examining board, the payment of a license fee and yearly renewal fee. In three of the states named a bond is required, the amount of the bond being $1,000 in Maryland and $2,500 in both Tennessee and Louisiana. License laws are now before the legislatures of the States of Oregon, California, Indiana and Massachusetts, and electrical contractors in these states are very actively engaged in securing their passage.

There are ordinances governing the installation of electrical work in the following cities: Moline, Rock Island, Peoria and Chicago in Illinois; Newark and Camden in New Jersey; Kansas City, Mo.; San Francisco and San Diego, Cal.; Toledo, Ohio; Minneapolis, Minn.; Louisville, Ky.; Denver, Col.; Medford, Mass.; Madison, Wis.; Indianapolis, Ind.; New Haven, Conn.; Jamestown, N. Y.; Sioux City, Ia.; Memphis, Tenn., Little Rock, Ark. Proposed ordinances are being considered in the cities of Gary, Ind.; Watertown and Buffalo, N. Y.; New Orleans, La., and Newark, N. J.

Commenting on the various laws and ordinances, Mr. Jaehnig says the Louisiana law was declared unconstitutional on the ground that it discriminated in favor of the public service companies, or was class legislation. The Maryland law is not entirely satisfactory, owing principally to lack of proper application and enforcement. The recent Chicago ordinance is not satisfactory as it does not provide for an examination and as anyone can secure a license by paying the required fee and being vouched for by two citizens.

Sioux City, Ia., reports that its ordinance is working well. Jamestown, N. Y., reports the ordinance and its provisions satisfactory, but weak in enforcement. Peoria, Ill., reports the ordinance satisfactory. Denver, Col., has a very complete ordinance which is working out satisfactorily, although there is a little trouble enforcing all its provisions. Kansas City, Mo., reports the ordinance not working to suit the contractor. It does not provide for an examining board, hence any one can secure a license by paying the fees. The fees are too high. The contractors recommend an examining board, reducing the fees and eliminating the bond required.

Camden and Newark, N. J., report their ordinances are working out satisfactorily although experience has shown where improvements can be made.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Fourth of the Series of Public Utility Lectures.—On March 30 the fourth of the series of public utility lectures will be given in the West Side Branch of the Young Men's Christian Association in New York. At that time Dr. E. P. Hyde, director of the physical laboratory of the National Lamp Works, at Cleveland, Ohio, will speak on "Progress in the Science of Lighting."

Motor-Converter Sets Ordered for Canadian Factories.—Bruce, Peebles & Company, Ltd., of Edinburgh, Scotland, have received orders for two 350-kw motor-converters for the Canadian works of Armstrong, Whitworth & Company, of Manchester, England, and for one 250-kw set for the Canada Cement Company. The converters are built under the Peebles-la Cour patents. In European electrical engineering practice this apparatus is used to a considerable extent, being favored for some services over the usual type of rotary converter or the motor-generator set.

Appearance of Ford Electric Not Imminent.—Rumors have been circulating recently to the effect that Ford electric cars have been supplied for demonstration purposes to numerous Ford agencies, but this rumor has been authentically denied. It is true that investigations are in progress, with the end in view of producing a cheap and serviceable electric car, and several test cars are in operation. Even if the desired results should be secured within the near future, it is stated authoritatively that no electric cars would be placed on the market before July, 1915.

Equipping Lamp Salesmen with Voltmeters.—The National Quality Lamp Works are preparing to equip their lamp salesmen with a new type of voltmeter, which has recently been developed by the General Electric Company. This instrument, known as the "lamp specialist's meter," is about half the size and weight of a standard portable meter and is designed to stand the hard usage that the service will entail. These meters are being provided in order to enable the salesman to see that his customers receive lamps of the proper voltage for their needs and to enable him to analyze service difficulties and find the cause for "kicks."

Chicago to Have a 1914 Electrical Show.—Preparations are under way for Chicago's 1914 electrical show, which will be held under the direction of the Electrical Trades Exposition Company at the Coliseum from Oct. 31 to Nov. 14. Manager H. E. Niesz has not sent out a formal announcement of the 1914 show to the trade, as it is his intention to give the exhibitors of the 1911 show an option until May 1 on the original space they occupied in the last show. Electrical show offices have been opened in Suite 546, Commercial National Bank Building, Clark and Adams Streets, Chicago, where diagrams and other information may be secured by prospective exhibitors.

Hydroelectric Development Planned in North Carolina.—Construction work will be started shortly on the hydroelectric plant of the Southern Power Company at Lookout Shoals on the Catawba River, near Statesville, N. C. The ultimate rating of the site is estimated to be 26,000 hp approximately. The completion of this project will give the Southern Power Company an aggregate generating capacity of 154,000 hp, of which 98,000 hp is now represented by four hydroelectric plants and 30,000 hp by three auxiliary steam generating stations. The B. H. Hardaway Contracting Company, of Columbus, Ga., is to do the construction work on the dam and power house at the Lookout Shoals development. The Parker Brooks Construction Company, of Macon, Ga., has secured the contract for building a 5-mile line of railroad from the Southern Railway to the site of the new station. The Southern Power Company is controlled by the Duke interests.

Alberger Pump Installed for Elevator Service.—The Union Electric Light & Power Company, of St. Louis, Mo., has recently installed in its Neighborhood Plant a 10-in., three-stage Alberger turbine pump of 1500 gal.-per-minute capacity, working against a discharge pressure of 135 lb. per sq. in. The pump is to be used to maintain the service for ten hydraulic elevators in the Central National Bank and the Chemical Buildings during the summer months when the steam pump will be shut down. The new pump is directly connected to a 175-hp, 230-volt direct-current motor obtained from the Sprague Electric Works. An operating speed of 1200 r.p.m. will be used with this motor, which is the largest one that the Union Electric Light & Power Company has yet installed.

A Westinghouse Lamp Factory for Milwaukee.—To supplement the output of its factories in New York City and in Bloomfield, N. J., the Westinghouse Lamp Company is now equipping a plant in Milwaukee, Wis., which will have a daily output of approximately 10,000 tungsten lamps. The building to be occupied was originally constructed for the Kissel Motor Car Company but stood idle up to the time it was taken over by the Westinghouse company. The new factory will be equipped during the summer months and it is expected will be in operation in time to supply the fall trade. Approximately 1000 employees will be put to work at the opening of the plant. A note appeared in the Jan. 24 issue of the *Electrical World* stating that the above move was contemplated, and that it was significant of a general policy of expansion.

Refrigerating Plant for Hudson Terminal.—The Carbondale Machine Company, of Carbondale, Pa., has just signed a contract with the Hudson & Manhattan Railroad Company for the installation of a Parsons "Quick Freeze" system, with 18 tons of ice daily capacity, in the Hudson Terminal Buildings, 30-50 Church Street, New York City. These buildings now contain an absorption refrigerating plant installed by the same company. The particular point of interest in this new system is that it will include three tanks, each containing twenty 300-lb. cans, which will freeze in twelve hours with 8-deg. brine. These tanks, together with the thawing system, whereby the ice is withdrawn from the stationary cans, the distilling equipment, all the necessary pumps, and an ice-storage room with a capacity of 25 tons of ice, are contained in a floor space measuring 23 ft. by 23 ft.

Panama Pacific Exposition Work Progressing.—The following extract from a recent official bulletin on the Panama Pacific Exposition work will be of interest to prospective exhibitors and visitors: "The following foreign nations have accepted the invitation of the United States to participate in the exposition: Argentina, Bolivia, Brazil, Canada, Chile, China, Costa Rica, Cuba, Denmark, Dominican Republic, Ecuador, France, Guatemala, Haiti, the Netherlands, Honduras, Italy, Japan, Liberia, Mexico, Nicaragua, New Zealand, Panama, Persia, Peru, Portugal, Salvador, Spain, Sweden, Turkey, Uruguay, Venzuela. It is now assured that practically all the states of the Union will be represented. All exhibit palaces are in process of construction under time contracts requiring completion by July 1, 1914. Machinery Hall, the largest building of the group, is complete save certain details of interior finishing, and many of the other palaces are under roof. Exhibitors in all parts of the world are therefore assured that they may soon begin shipment of their exhibits, certain that those received after July 1 of this year may be immediately installed and made ready for the completed opening Feb. 20, 1915." It is also of interest to note that the plans and specifications for the electrical work on the California Building are al-

most complete and that the contract for the electrical work in the Court of Palms and the Court of Flowers has already been awarded. Orders have been placed for the auxiliary equipment required for the three main generating stations supplying direct current for exhibitors and for decorative lighting. An order was placed a couple of weeks ago with the Wheeler Reflector Company, of Boston, Mass., for 2154 reflectors, varying in diameter from 7 in. to 11 in. These will be made of steel with lacquered aluminum finish and will be used in the several exhibit halls.

Operation of Electric Welding Plants by Contract.—The Electric Welding Company, 220 West Forty-second Street, New York City, has devised a plan whereby it undertakes the operation of a manufacturer's plant at a stipulated price. According to this plan it is not even necessary for a manufacturer to install a special welding plant, provided that he has a source of direct current available, as the welding company is prepared to furnish controllers suitable for any commercial voltage. However, in cases where there is a considerable amount of work to be done, it will pay in energy economy to install a special welding plant. The first company to try the plan was the Nichols Copper Company, of Laurel Hill, Long Island, which has now operated its plant for over two and one-half years in this manner, during which time various new methods have been introduced. In the Nichols plant there is a very extensive industrial railroad system and great trouble was formerly experienced with wheels coming loose from the car axles. This trouble has been entirely eliminated by welding the wheels to the axles, as described in the Oct. 11, 1913, issue of the *Electrical World*.

Manufacturer of Transmission-Line Specialties Active.—An order has been received from the Chile Exploration Company by the Clark Electric & Manufacturing Company, Singer Building, New York, for a large quantity of seamless splicing sleeves to be used on the former company's copper transmission and steel ground lines in South America. Last week, at the New York Electrical Testing Laboratories, a ⅜-in. Siemens-Martin steel cable, twisted into a standard seamless tinned copper splicing sleeve, broke outside of the sleeve before pulling out from it and developed approximately 99 per cent of its ultimate tensile strength. A sample of 000 standard copper conductor developed practically its full tensile strength. It is believed these high results are due to the use of the latest type of steel-twisting tools furnished by the company. Another large shipment of sleeves will be made to the Ebro Irrigation & Power Company, Barcelona, Spain, in the near future, on order from the Pearson Engineering Corporation, of New York. Recent orders have been received from the Connecticut River Transmission Company, the Eastern Pennsylvania Railways Company and the American Gas Company for overhead protective clamping sets for use at railroad right-of-way and telephone crossings.

Large Vacuum Cleaning Units for the Canal Zone.—In the Jan. 31 issue of the *Electrical World* note was made of the installation by the American Rotary Valve Company of six large vacuum cleaning outfits in the administration building at Balboa, Canal Zone. A recent communication from the company contains a complete description of the apparatus installed. Each machine is of the reciprocating, double-acting, positive displacement, engine type, motor-driven through a silent endless belt. The machine is entirely inclosed and is self-oiling by a combination of the splash, fountain and force-feed systems. The air cylinder measures 18 in. by 10 in., giving a displacement of approximately 650 cu. ft. per minute at 220 r.p.m. This apparatus will operate at any desired vacuum, with from one to six hose lines in use. The vacuum is automatically controlled and maintained, as the air volume varies, by means of an unloading device, which automatically adjusts itself so as to by-pass, from one end of the cylinder to the other, enough air to make up the difference between the actual displacement and the air being taken in through the cleaning appliances in operation. The machine is equipped with a rotary valve which turns continually in the same direction, with ports interchangeable at 180 degrees. This valve rotates in oil, operates without wear and is noiseless. It is driven from the main shaft through gearing and is arranged so that it can be turned through an angle of 180 degrees, thereby converting the machine into an air compressor. This is done when compressed air is desired for blowing out dust from obscure corners and when it is desired to clean out the receiving tank, which is done under pressure. Separation is effected in this machine by drawing the dirt-laden air through water. The base of the machine is a hollow casting, in one end of which there is a rotary agitator, driven by a belt from the main shaft. The refuse is drawn in at this end and blown directly against the agitator. This mixes it thoroughly with the water, which catches the dirt and allows the air to escape. The machine is driven by a 25-hp, 220-volt, twenty-five-cycle, three-phase Jenney motor.

Customs Concerning Commercial Travelers in Peru and Ecuador.—Since 1909 a government tax of about $50 has been collected for each visit of a foreign commercial traveler to Ecuador. Samples are admitted duty free into that country for periods of three, six, nine or twelve months, as arranged, on furnishing of the usual bond guaranteeing final payment or re-exportation. In Peru there is no national tax on foreign agents, but small local taxes are imposed in some towns. At present samples may be admitted duty free for various periods up to but not exceeding three months, and the following rules, formulated in 1912 by the Peruvian Minister of Finance and effective July 13, 1912, cover this privilege: Importers of samples shall present in each case, in duplicate, an itemized statement containing the following data: Marks, numbers and weight of each package; enumeration of all the articles contained in each package with the proper designation and tariff number of each article, as set forth in the customs tariff; description of each article and gross weight, legal weight, net weight or dimensions, as the case may be. Only one article of each kind may be imported unless there is a difference in quality, shape, size, weight and color. Articles which are free of duty under the customs tariff may be imported without the foregoing formalities. Articles the importation of which as samples is not permitted may remain in customs storage at the expense of the importer. The duties on articles which are admitted shall be deposited in cash or in the form of a bank draft. The cash will be refunded or the draft returned upon re-exportation of the goods and payment of such storage charges as may be incurred. In each case the customs officials will fix a period, not to exceed three months, for the re-exportation of the samples. If proof of the re-exportation within the period determined upon is not submitted, the amount of duties will not be refunded or the bank draft will be cashed, as the case may be. For the re-exportation of all or part of the samples, the importer shall present the goods in ample time at the custom house, in order that the contents of the packages may be checked up. If, on examination, any of the articles is missing, or has been altered in weight or measure, or has been replaced by another, twice the amount of the duty on the article will be collected and the article substituted will be confiscated.

NEW YORK METAL MARKET PRICES

	Mar. 17		Mar. 24	
Copper:	Bid	Asked	Bid	Asked
Standard spot*	13.60	14.25	13.87½	14.37½
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard, spot*	63 16 3		65 7 6	
Prime Lake	14.50	to 14.75	14.75	to 14.87½
Electrolytic	14.12½	to 14.25	14.40	to 14.50
Casting	14.00	to 14.12½	14.20	to 14.30
Copper wire base	15.50	....	15.50	to 15.75
Lead	4.00		4.00	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.00		7.00	
Spelter, spot	5.35	....	5.32½	....
Tin, spot	38.10	to 38.50	38.70	to 38.80
Aluminum:				
Prompt delivery	18.00	to 18.25	18.00	to 18.25
Future	18.00	to 18.25	18.00	to 18.25

*OLD METALS

Heavy copper and wire	13.62½	13.62½
Brass, heavy	8.62½	8.62½
Brass, light	7.62½	7.62½
Lead, heavy	4.00	4.00
Zinc, scrap	4.25	4.25

*COPPER EXPORTS

Total tons to March 24 34,065

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Missouri Utility to Issue Bonds.—Permission has been received from the Missouri Public Service Commission by the St. Joseph Railway, Light, Heat & Power Company for the issue of $162,000 of 5 per cent bonds, the proceeds of which are required for financing extensions and improvements. This company is a subsidiary of the Cities Service Company.

Postponement in Negotiations to Combine Telephone Properties in Chicago.—The Chicago City Council committee on gas, oil and electric light has deferred action until the early part of May (after the April election) in relation to the matter of sanctioning the sale of the telephone properties of the Chicago Tunnel Company (the automatic system) to the American Telephone & Telegraph Company for the Chicago Telephone Company.

Western Electric Company of Ohio to Be Dissolved.—The Western Electric Company of Ohio, a subsidiary of the Western Electric Company, which is an Illinois corporation, is to be dissolved as an Ohio corporation, and a meeting will be held in Cincinnati on March 28 to take the necessary action. The dissolution is merely a matter of change in form since the Western Electric Company of Illinois has been authorized to do business in Ohio.

Cities Service Company Planning Stock Increase.—At the annual meeting of the stockholders of the Cities Service Company in Dover, Del., on April 7, consideration will be given to the question of increasing the authorized capital stock of the company from $50,000,000, divided into $30,000,000 preferred and $20,000,000 common stock, to $65,000,000, divided into $40,000,000 preferred and $25,000,000 common stock. It is officially stated that no immediate plans are held for the sale of any of this extra stock, but that a margin is desired, so that this can be done at short notice any time in the future when it seems desirable.

Massachusetts Instrument Companies Merged.—The Foxboro Company, recently organized under the laws of the Commonwealth of Massachusetts, has taken over all assets and liabilities of the Industrial Instrument Company of Connecticut and of the Standard Gauge Manufacturing Company of Connecticut, with factory at Foxboro, Mass. The first-mentioned company manufactures the Foxboro improved recording gages, thermometers, tachometers and pyrometers sold by the Industrial Instrument Company, which has its main office at Foxboro with branch offices at 50 Church Street, New York; 1363 Monadnock Building, Chicago; 1984 Railway Exchange Building, St. Louis; 461 Market Street, San Francisco, and 832 Brown-Marx Building, Birmingham, Ala. E. H. Bristol and B. B. Bristol continue as president and treasurer respectively of the Foxboro Company, and there are no other changes in the personnel or policies of the merged companies, the consolidation being effected merely to concentrate and simplify the organization.

United States Light & Heating Company Plans Bond Issue.—A special meeting of the stockholders of the United States Light & Heating Company has been called for April 9, at Portland, Me., for the purpose of authorizing an issue of $1,500,000 first mortgage fifteen-year bonds, the proceeds of which will relieve the present shortage of working capital. Following the work of the investigating committee recently appointed to look into the company's production and distribution systems, with an idea of increasing their efficiency, announcement has been made of the determination to move the main office of the company from New York to Niagara Falls, where the factory is situated. This change will take effect on May 1, and thereafter only a sales office and distributing station will be maintained at New York. This step is expected to produce a large saving of expense, and, if the bond issue is authorized, the combined effect will be very favorable to the company. The recent business of this company has been normal, with shipments averaging $200,000 a month, although its railroad car lighting and heating business has not been very active lately. A. H. Ackerman, general manager of the company, stated to an *Electrical World* representative that the contemplated changes have no significance, aside from the greater economy that is expected from them.

Allis-Chalmers Company Matters.—The balance sheet of the Allis-Chalmers Manufacturing Company, as of Dec. 31, 1913, was recently made public, together with a statement of the condition of that concern's business. The company had on that date capital assets of $32,043,305 and current assets amounting to $13,260,275. Its capital stock consisted of $16,500,000 preferred and $26,000,000 common stock, and it had current liabilities of $1,042,501, reserves amounting to $241,490 and a surplus of $755,124, which represented the profits from the commencement of business of the Allis-Chalmers Manufacturing Company on April 16, 1913, to Dec. 31 of that year. J. H. McClement, chairman of the board of directors, stated that there was a decided falling off in business from early in August up to the end of the year, in sympathy with the general slackening of business throughout the country, and that this reduction was reflected in a decrease of the company's profits. At a meeting of the board of directors on March 6 it was decided not to pay a dividend on preferred stock out of the surplus, action being deferred until such time as the profits and business prospects of the company will justify the expectation that dividends can be declared and maintained at a specified rate.

Annual Report of the Electric Storage Battery Company.—The annual report of the Electric Storage Battery Company, of Philadelphia, Pa., recently issued, showed a net income from sales of $1,035,917 and a net surplus amounting to $558,791 for the year ended Dec. 31, 1913. The total surplus on the above date was $3,312,523. The company had $1,885,920 invested in its plants and its total fixed assets amounted to $18,892,764. The total current assets came to $3,341,151. The company is capitalized at $18,000,000, of which $155,000 is preferred and the remainder common stock. Current liabilities on the above date amounted to $164,758. The year 1913 was an active one for this company. Its product was sold extensively for automobile lighting and starting service, for street-railway work, for constant voltage axle lighting in connection with steam railroads, and for power-plant installations. Among the larger individual orders placed for its batteries were that for forty-three sets by the New York Railways Company, for operating storage-battery cars on one of its cross-town lines; that for sixty-two axle lighting sets by the Atchison, Topeka & Santa Fé Railway Company, and that for a 156-cell battery by the Indianapolis (Ind.) Light & Heat Company for excitation and emergency service in its generating station. During the year this company has been working on the development of an improved method of end-cell switch control, and these switches are now being built for continuous service on currents up to 10,000 amp. On Dec. 1 the company celebrated its twenty-fifth anniversary.

Western Electric Company Has Successful Year in 1913.—The report of the Western Electric Company for the year ended Dec. 31, 1913, gives information concerning the remarkable business of that corporation during the past year. Gross sales for that period amounted to $77,532,860, and manufacturing expenses totaled $71,689,555. Net earnings came to a total of $6,563,861 and after deducting $1,500,000 paid out in dividends during the year and $2,500,000 reserve, the surplus for the year amounted to $1,671,695. The balance sheet as of Dec. 31 showed total assets of $74,068,318, of which $18,703,823 represented investment in plants and $16,966,856 covered the value of raw materials and finished stock on hand. The company has an outstanding stock of $15,000,000 and a bonded debt of the same amount in first mortgage 5 per cent gold bonds maturing Dec. 31, 1922. Its current liabilities amounted to $5,660,517 at the close of 1913, and its total surplus at that time amounted to $22,840,459. A statement by H. B. Thayer, president of the company, accompanied the report and read, in part, as follows: "In view of the prospect of a smaller business in our own products in 1914, and some changes in types, it has seemed advisable to apply more than the usual depreciation to our valuation of completed merchandise. A large part of our manufacturing plant is of recent construction and therefore the standard rates of depreciation have not sufficed to produce a net valuation as low as conservative accounting would dictate, on a highly specialized plant. We have therefore applied this year an extra depreciation to our plant accounts."

Business Notes

The Western Lamp & Brass Company, Chicago, Ill., will move shortly into new quarters at 156 West Lake Street.

The Cooper Hewitt Electric Company will shortly move its Chicago office, in charge of G. C. Keech, to 506 Fisher Building, that city.

The Julius Andrae & Sons Company, Milwaukee, Wis., has secured the services of W. A. De Forest as its Minneapolis representative.

The Adams-Bagnall Electric Company, Cleveland, Ohio, has appointed V. N. Marker as manager for the Northwest, with headquarters at 639 Andrus Building, Minneapolis, Minn.

The United Ice Improvement Company has moved its office to 50 Church Street, New York, and will use the refrigerating system to be installed by it in that building for demonstration purposes.

The J. P. Hall-Smith Company has been formed to take over the electrical contracting business established by J. P. Hall in 1891. The offices of the company will be at 320 Fifth Avenue, New York.

The Ferley Electric Company has recently been formed with offices at 51 North Fifty-seventh Street, Philadelphia, Pa., to carry on an electrical contracting business in Philadelphia and vicinity. G. D. Fernandez and D. G. Daley are partners in the company, which is not incorporated.

The Meister Engineering Company, electrical engineer, with offices at 500 Reliance Building, Kansas City, Mo., has been organized by J. F. Meister to do general engineering work and to act as selling agent for Crocker-Wheeler electrical machinery and for Ward-Leonard control apparatus.

The Monitor Controller Company, Baltimore, Md., has announced the removal of its Philadelphia office to 1533 Chestnut Street. Walker Brothers & Haviland are in charge of this office. Arnold Erlanger has been appointed assistant to J. F. Frese, district manager for New York City, with office at 30 Church Street.

The L. G. Schoepflin Company, of Buffalo, N. Y., has entered the field as a maker of electric commercial vehicles. Mr. Schoepflin has had a wide experience as a wagon manufacturer and more recently has turned his attention to the manufacture of trucks. Mr. J. H. Thompson has opened a Chicago office for the new company at 20 East Jackson Boulevard.

New Industrial Companies

The Bodine Electric Company, of Chicago, Ill., has been incorporated with a capital stock of $50,000 by C. D. Bodine, J. F. Bodine and P. J. Bodine. The company proposes to manufacture and deal in electrical apparatus and machinery.

The Van Curve Light Company, of Green Island, N. Y., has been incorporated with a capital stock of $10,000 to manufacture mechanical devices by W. H. Babbitt, T. E. Vanderwerker and Robert Caldwell. Green Island has not a post office.

The Moore Automatic Fire Escape Company, of Passaic, N. J., has been incorporated with a capital stock of $25,000 by P. Simon, E. T. Moore and S. J. Moore, of Passaic, N. J. The company is capitalized at $25,000 and proposes to do a general mechanical and electrical engineering business.

The E. W. Ham Electric Company, of Worcester, Mass., has been chartered with a capital stock of $99,000 to do a general electrical contracting business and to deal in electrical devices. The officers are: J. Brinton Bailey, president; Edwin W. Ham, treasurer, and Paul Fielden, clerk.

The South Electric Manufacturing Company, of New York, N. Y., has been incorporated by W. S. Lison, C. R. Peddle and L. C. Randolph, of New York, N. Y. The company is capitalized at $25,000 and proposes to manufacture and deal in machinery and mechanical devices and to do a general contracting electrical and mechanical engineering business.

Trade Publications

Battery-Charging Sets.—The Lincoln Electric Company, Cleveland, Ohio, has just issued a pamphlet of directions for setting up, operating and adjusting its rotary battery-charging sets.

Metal Signs.—The Electric Service Supplies Company, Philadelphia, Pa., has just put out a poster describing its electrically illuminated metal signs for use in connection with the "safety first" movement.

Electric Trucks.—A three-page folder put out recently by the L. G. Schoepflin Company, Buffalo, N. Y., gives information on that concern's new line of electric delivery wagons of 500-lb. to 1500-lb. capacity.

Meters.—Folder No. 272, issued by the Esterline Company, Indianapolis, Ind., refers to its graphic meters. An illustrated description is given of the design and operation of various types of Esterline graphics.

Live Material.—Section DS 842 of the Westinghouse Company is a trolley line material catalogue. It describes bracket arms for direct and catenary construction. Complete information, together with illustrations, is given about various types.

Transformers.—A leaflet has been issued by the Wagner Electric Manufacturing Company, St. Louis, Mo., bearing the title "The Proof of the Pudding." It refers to nine Wagner transformers, installed in 1898, which have shown 98.4 per cent efficiency after sixteen years' continuous service.

Governor Air Compressor.—The General Electric Company recently issued Bulletin 44590, describing its type ML governor for automatically controlling the operation of either stationary or railway motor-driven air compressors in order to maintain air pressure in a storage reservoir between predetermined limits.

Electric Vehicles.—A large folder has been issued by the Buffalo Electric Vehicle Company, Buffalo, N. Y., referring to its light-duty trucks. These trucks are built in two sizes, 1500-lb. and 2000-lb. capacity. The principal specifications of the 1500-lb.-capacity chassis are given, as well as a picture showing the operating mechanism of the shaft drive.

Poles.—A leaflet referring to its chestnut poles has been issued recently by the Chattanooga Pole Company, Chattanooga, Tenn. This company has specialized in chestnut poles for fourteen years and carries a large stock of sizes varying from 20 ft. to 90 ft. An illustration of the 66,000-volt transmission line of the Tennessee Power Company is given showing poles which were furnished by the Chattanooga Pole Company.

Aluminum Lightning Arresters.—The General Electric Company recently issued a bulletin describing its aluminum lightning arresters for alternating-current circuits. The bulletin consists of thirty-two pages, filled with detailed information relative to these arresters and choke coils for use with them, with notes on the charging operation, installation and ground connections. There are also diagrams and tables of dimensions of both arrester and choke coils.

Small Motors.—Small Moters, No. 18, published by the Westinghouse Electric & Manufacturing Company, covers the application of small alternating-current and direct-current motors. A detailed description is given of the construction of these motors, accompanied by photographs of the various parts. There is also given the application of these two motors to various devices, such as washing machines, vacuum cleaners, piano players, pumps, sign flashers and ironing machines.

Condensers and Auxiliaries.—The C. H. Wheeler Manufacturing Company, Philadelphia, Pa., has brought out a creditable little volume on the subject of its condensers and auxiliaries. Interesting chapters on the economy of high vacuum and the thermodynamics of condensers are followed by sections devoted to condensers, displacement vacuum pumps, centrifugal circulating pumps, feed-water heaters, engines, water-cooling towers and other apparatus manufactured by the Wheeler company. The descriptive matter is of a practical nature and is well illustrated.

Personal Mention

Mr. H. A. Mohr has been appointed superintendent of distribution of the Lehigh Navigation Electric Company, with headquarters at Siegfried, Pa.

Mr. S. R. Blakemore, of Senatobia, Miss., has been appointed superintendent of the city water and electric plant at Dyersburg, Tenn. Mr. Blakemore has had charge of the Senatobia plant for the past four years.

Mr. J. M. Atkinson, Jr., formerly assistant manager of the Missouri Valley Light & Power Company of Eldorado Springs, Mo., has accepted the position of manager of the La Plata (Mo.) Light, Heat & Ice Company.

Mr. William P. Bear, formerly sales engineer of the Sprague Electric Works of the General Electric Company, has accepted a position as representative of the Trumbull Electric Manufacturing Company, with headquarters in Chicago.

Mr. P. T. Davies, of the Montreal (Que.) Light, Heat & Power Company, has been appointed alternate statesman of the Jovian Order for the Province of Quebec. The Montreal members are holding a weekly series of dinners, lectures and entertainments at the Commercial Travelers' Club.

Mr. S. R. Blakeman, who for the past four years has been connected with the Senatobia (Miss.) lighting and water plant as superintendent, has been appointed superintendent of the Dyersburg (Tenn.) water and lighting plant. Mr. Blakeman is a graduate of Purdue University, class of 1909.

Dr. Samuel Sheldon, to whom the alumni and undergraduates of the Polytechnic Institute of Brooklyn, his friends and professional associates tendered a dinner on March 21 in commemoration of twenty-five years of service as a professor in electrical engineering, is well known in engineering circles. Through honesty of purpose and by persistent industry and enthusiastic aggressiveness he has attained success as an experimental physicist, electrical engineer and scientific writer. Born in Middlebury, Vt., in 1862, he received such education as the public schools afforded and entered Middlebury College in 1879, supporting himself while there by an endowment prize scholarship which he won and retained throughout the four years. As a student he excelled in mathematics, physics and philosophy. His natural versatility resulted in his being popular with his college mates and enabled him to hold the position of organist of the college chapel choir and of the choir in St. Stephen's Church. He was graduated in 1883, with the degree of A.B., and remained at Middlebury two years as instructor in mathematics. In 1887 he received the degree of A.M. In the fall of 1885 he entered the University of Würzburg, Germany. During his first year he was selected by Professor Kohlrausch to assist in special investigations, among which was the classic determination of the ohm for the Bavarian government. During his last year he held the position of assistant in laboratory physics and was graduated in 1888 with the degree of Doctor of Philosophy. Returning to America, he was at once made first assistant in physics under Prof. John Trowbridge at Harvard University, where, in collaboration with that eminent physicist, he conducted many original investigations in magnetism, the results of which were embodied in papers presented before the American Academy of Arts and Sciences. The next step in Dr. Sheldon's advancement was his call to the Polytechnic Institute of Brooklyn as professor of physics and as professor in the newly organized department of electrical engineering. These positions he has filled for a quarter of a century, with increasing credit to himself not only as a teacher but also as an administrator in organizing and managing the departments in his charge. Under his supervision the shops, mechanical engineering, physical and electrical engineering laboratories were installed. Dr. Sheldon has frequently been called to give testimony in both the state and federal courts, and since 1903 he has been an expert of the Swiss Department of Justice and Police. He has also carried on an extensive consulting engineering practice embracing all branches of electrical engineering. His reports of experimental investigations to the Electro-Therapeutic Association constitute a valuable contribution to science and to the art relating to electrostatic machines. His textbook contributions have received well-merited recognition. He revised the fourth edition of Olmsted's College Philosophy, entitled "An Introduction to Natural Philosophy," in 1891, and since 1900 he has acted as critic for the D. Van Nostrand Company. He is the revising editor of, and contributor to, several sections of Foster's Electrical Engineers' Pocketbook. He is also editor of definitions pertaining to electricity in the new Standard Dictionary. Dr. Sheldon is also the senior author of "Dynamo-Electric Machinery," "Alternating-Current Machines" and "Electric Traction and Transmission Engineering." He is a fellow of the American Institute of Electrical Engineers and served on the board of managers for six years, as vice-president for two years, and as president for the year 1906-1907. He was chairman of the papers committee, 1902-1906; chairman of the standards committee, 1908; chairman of the library committee since 1910, besides co-operating on various other committees. He is also a fellow of the American Association for the Advancement of Science, a fellow of the Brooklyn Institute of Arts and Sciences and president of its department of electricity, a fellow of the American Electro-Therapeutic Association, a member and past-president of the New York Electrical Society, and is a member of the American Physical Society, the Society for the Promotion of Engineering Education, the American Electrochemical Society and the American Electric Railway Association. The University of Pennsylvania and Middlebury College honored Dr. Sheldon with the degree of Doctor of Science in 1906 and in 1911, respectively.

DR. SAMUEL SHELDON

Mr. James D. Mortimer has been elected president of the North American Company to succeed Mr. James Campbell, who became chairman of the board of directors. Mr. Mortimer came to New York in March, 1905, to take the position of engineer for the Electric Bond & Share Company. Previously he had been engineer for the Puget Sound Power Company. Later he was made manager of the operating department and vice-president of the Electric Bond & Share Company. He resigned from the latter position in October, 1909, to become vice-president of the North American Company and continued in that office until his accession to the presidency last week. Mr. Mortimer is now president and director of the following companies: North American Company, Wisconsin Edison Company, Inc., Milwaukee Electric Railway & Light Company, Milwaukee Light, Heat & Traction Company, Wisconsin Gas & Electric Company, Watertown Gas & Electric Company, Union Electric Light & Power Company, Electric Company of Missouri and St. Louis County Gas Company. Mr. Mortimer is also vice-president and director of the West Kentucky Coal Company and director of the Allis-Chalmers Manufacturing Company and Utah Securities Corporation.

Obituary

James S. Cummins, senior member of the law firm of Cummins, Stearns & Milkewitch and vice-president, director, senior counsel and one of the founders of H. M. Byllesby & Company, died on March 23 at his home in Chicago. Mr. Cummins was born in Pennsylvania in 1857. He was a graduate of Swarthmore College and was admitted to the bar in his native state in 1882. In 1889 he was married to Alice Charlotte Byllesby. Two years later he came to Chicago and became counsel for the Thomson-Houston Electric Company, and he also served as counsel for the General Electric Company in Chicago when the latter company was organized in 1892. Ten years later he helped to found H. M. Byllesby & Company, and he was closely connected with that extensive public utility organization until his death.

Construction

New England

SANFORD, MAINE.—At the annual town meeting it was voted to improve the street-lighting system in the business section of the town. It is proposed to erect 50 two-lamp clusters on Washington Street and Main Street, from Hotel to Windor Street. The ornamental posts are to be furnished by private subscription.

MONTPELIER, VT.—A committee, consisting of W. C. Colton, George Blanchard and Benjamin Gates, has been appointed by the Board of Trade to negotiate with the Consol. Ltg. Co., of Montpelier, in regard to the installation of a better lighting system in the business district of the city. H. D. Larrabee is manager of the company.

RICHFORD, VT.—Preparations are being made to enlarge and improve the furniture plant of the Richford Mfg. Co. An addition 48 ft. by 51 ft., three stories high, will be built, equipped with electrically driven machinery. Orders have been placed for a 225-kw to 250-kw generator, motors and other accessories necessary. Construction work will be started about April 1.

EASTHAMPTON, MASS.—The Public Service Commission has granted the Easthampton El. Lt. Co. permission to issue $10,500 in bonds, the proceeds to be used for improvements to its lighting system.

MELROSE, MASS.—Plans are being considered by the city officials for the installation of an ornamental street-lighting system for the business section, including larger lamps from Wyoming Avenue to Porter Street through the center of the city.

PLYMOUTH, MASS.—The Plymouth El. Lt. Co. is planning to extend its cable lines to the Marconi station at Marion and along the northernly banks of the Cape Cod Canal. The company, in addition to furnishing electricity for the Marconi station, will furnish electrical service in several of the adjoining towns.

SHELBURNE FALLS, MASS.—The New England Pwr. Co. is planning to expend about $1,000,000 this year to finish the construction of its No. 5 plant on the Deerfield River. This development will furnish a water-head of 245 ft., and will generate approximately 30,000 additional hp for the transmission lines of the system. The main office of the company is at 50 Congress Street, Boston, Mass. George S. Smith, of Boston, is president of the company and E. L. Wise, of Worcester, manager.

WORCESTER, MASS.—Contracts have been awarded by the Worcester Pressed Steel Co. for the erection of a new cold roll mill. The plant will be equipped for electrical operation; the equipment will include one 500-hp, 550-volt alternating-current roll-mill motor with reversing self-starter, two new switchboard panels and three 300-kva transformers; also several smaller motors, totaling about 100 hp. J. E. McClaren is chief electrician.

WOONSOCKET, R. I.—The Blackstone Valley Gas & El. Co., of Woonsocket, has submitted a proposition to the Town Council of North Smithfield, offering to furnish electricity for lighting that town.

WOONSOCKET, R. I.—Resolutions have been signed authorizing Mayor Daignault and the joint standing committee on street lights to enter into a contract with the Blackstone Valley Gas & El. Co., of Woonsocket, to install 28 new ornamental arc lamps of the inverted luminous type on Main Street and adjacent squares.

Middle Atlantic

ALBANY, N. Y.—Bids will be received by the trustees of public buildings, Executive Chamber, Capitol, Albany, until April 8 for electric wiring the west wing of the State Capitol, Albany, in accordance with specification No. 17. Drawings and specifications may be consulted and blank form of proposal obtained at the office of Lewis F. Pilcher, state architect, Capitol, Albany.

BUFFALO, N. Y.—The Niagara, Lockport & Ontario Pwr. Co., of Buffalo, it is reported, is contemplating building a subsidiary plant on Salmon River, near Pulaski, to supplement the amount of Niagara power in this State by 30,000 hp. S. Piek, of Buffalo, is assistant general manager.

CHERRY CREEK, N. Y.—At the annual election held March 17 the proposition to purchase electricity from the village of Randolph for street-lighting purposes in Cherry Creek was carried.

CROTON FALLS, N. Y.—George Juengst & Sons, owners of the local electric-light plant, expect to purchase within the next four months wire and other material for line construction. George Juengst, Jr., is manager.

DEPOSIT, N. Y.—The Deposit El. Co. has recently purchased and expects to have installed by May 15 a new 250-kw, three-phase, 2300-volt, 60-cycle, 200 r.p.m. General Electric generator, exciter and switchboard. John D. Mickle is manager.

ELLENVILLE, N. Y.—Within the next two months the Ulster Lake Co., of Ellenville, expects to install a 48-in steel flume (900 ft. long), build an addition to concrete dam, install gates, waterwheel, governors, etc. Contracts have already been placed for equipment and material. C. D. Divine is secretary.

GROTON, N. Y.—Within the next ten months the Board of Water and Light Commissioners expects to purchase a boiler for the municipal electric-light plant. Charles O. Rhodes is clerk.

HAMILTON, N. Y.—Within the next two months the Board of Water and Light Commissioners expects to purchase a boiler with a rating from 80 hp to 100 hp. E. L. Kingsbury is superintendent.

HERMON, N. Y.—Within the next three months the Hermon El. Lt. Co. expects to purchase four vacuum cleaners and one washing machine. W. G. Popple is manager.

NEW YORK, N. Y.—The New York Tel. Co. has filed plans with the Building Department for enlarging its present building at No. 24 Walker Street. It is proposed to build an addition of seven stories (increasing it to twenty-four) at a cost of $500,000. McKenzie, Voorhees & Guelin, of New York, N. Y., are architects.

ONEONTA, N. Y.—The City Council has entered into a contract with the Oneonta Lt. & Pwr. Co. for lighting the streets of the city for a period of five years from March 1, 1914. Under the terms of the contract the company is to furnish arc lamps of the present type at $72.50 per lamp per year. In addition, the city has the option of using cluster lamps in the business sections, consisting of four 60-cp lamps and one 100-cp lamp, at $80 per year for each cluster; also to use incandescent lamps wherever the committee may desire.

SONYEA, N. Y.—Bids will be received by Percy L. Lang, president of board of managers of Craig Colony for Epileptics, Sonyea, until April 14 for construction, plumbing and electric wiring and refrigerating equipment for cold-storage plant; construction of new carhouse; erection of chimney for power plant; furnishing and installing boilers, steam apparatus and piping, engines, generators, electric work and plumbing for central power plant at Craig Colony for Epileptics. Separate bids must be submitted on each division of the work and no combination of bids will be considered. Drawings and specifications may be consulted and blank forms of proposals obtained at the Craig Colony for Epileptics at Sonyea, and at the office of Lewis F. Pilcher, architect, Capitol, Albany.

SPENCERPORT, N. Y.—At an election held March 17 the proposal to appropriate $16,000 for the installation of an electric-light plant to furnish electricity for street-lighting and general purposes was carried.

STAMFORD, N. Y.—The West Branch Lt. & Pwr. Co., of Stamford, expects to purchase a few transformers, meters, some wire, insulators and lightning arresters. Leslie P. Grant is manager.

UNION SPRINGS, N. Y.—Within the next three months the Union Springs Lt. & Pwr. Co. expects to erect a small addition to its power house, also to purchase one 150-kw generator, switchboard panel for generator, 2 miles of wire for distribution line, poles, cross-arms, lightning arresters, etc., and two 40-kva transformers. F. L. Egleston is general manager.

HASTINGS, PA.—A petition has been presented to the Borough Council asking that steps be taken for improving the street-lighting system in Hastings.

CAMDEN, N. J.—Bids will be received by the Board of Chosen Freeholders until April 8 for the construction of power plant and installation of electrical equipment at the County Tuberculosis Hospital, at Ancora. Thomas Stephen, Masonic Temple, Camden, is architect. F. W. George is clerk of board.

CLAYTON, N. J.—We are informed that the contract awarded Moore Brothers Glass Co., of Clayton, for lighting the streets of the borough is a renewal of a previous contract. Reported in the issue of March 21 to have been awarded contract for street-lighting.

JERSEY CITY, N. J.—The Central R. R. of New Jersey, it is reported, is considering replacing the wooden poles for telegraph line with poles of steel or concrete construction.

MULLICA HILL, N. J.—Within the next two months the Harrison Heights Improvement Co. expects to install an extra panel to its switchboard with full equipment to handle alternating current in addition to its direct-current equipment. Clinton Iredell is secretary and engineer.

RIDGEFIELD, N. J.—Bids will be received by the Mayor and Borough Council until April 8 for furnishing street-lighting service to the borough of Ridgefield for a period of five years, consisting of two or more arc lamps of 1200 cp and 114 or more incandescent lamps of 32 cp, with all-night service. C. B. Wilson is borough clerk.

SPRING LAKE, N. J.—Bids will be received by the street lighting committee of the borough of Spring Lake until March 30 for furnishing electricity for lighting the streets and public places of the borough for a period of five years, beginning May 15, in accordance with specifications on file in the office of the borough clerk. The specifications provide for not less than 16 fixtures on the ocean front along the boardwark, and not less than 20 fixtures on Third Avenue, to be maintained through underground conduits. E. V. Patterson is borough clerk.

BALTIMORE, MD.—The contract for the erection of a power house at Homewood for the Johns Hopkins University is reported to have been awarded to Charles L. Stockhausen, Marine Bank Building, Baltimore. The building will be 70 ft. by 123 ft., two stories high, and will cost about $50,000. Plans were prepared by Parker, Thomas & Rice, architects, 712 North Howard Street, Baltimore.

EASTON, MD.—We are informed that as yet no definite action has been taken by the city of Easton upon the installation of a municipal electric-light plant. An item stating that the Legislature has passed the bill authorizing the municipality of Easton to establish a municipal plant was published in the issue of March 21.

WASHINGTON, D. C.—Bids will be received by the purchasing agent of the Post Office Department, Washington, D. C., until April 22 for furnishing miscellaneous supplies, including electrical supplies (motors, carbons, fuses, tape), stationery, computing, baling, addressing, canceling, opening, adding and perforating machines; also motor vehicle supplies, etc., as they may be ordered for use of the postal service from time to time during the fiscal year beginning July 1, 1914, and ending June 30, 1915. Blanks for proposals, with specifications to bidders, will be furnished upon application to the purchasing agent. A. S. Burleson is Postmaster-General.

WASHINGTON, D. C.—Bids will be received at Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 21 for furnishing at the various navy yards and naval stations the following electrical supplies: Brooklyn, N. Y., Schedule 6434—one six-drop water-tight annunciator, miscellaneous electric fixtures, 100 portable hooks, six portable voltmeters. Brooklyn, N. Y., and Philadelphia, Pa., Schedule 6434—miscellaneous non-water-tight bells and buzzers. Brooklyn, N. Y., and Mare Island, Cal., Schedule 6434—300 non-water-tight push-buttons. Brooklyn, N. Y., and Norfolk, Va., Schedule 6434—miscellaneous shade holders. Norfolk, Va., and Mare Island, Cal., Schedule 6434—miscellaneous junction branch boxes, etc. Mare Island, Cal., Schedule 6434—four 25-amp, 250-volt circuit-breakers, miscellaneous plate carbon, 175 lb. hard sheet rubber. East and West, Schedule 6434—3200 hard rubber bushings, miscellaneous pear push-buttons, miscellaneous sheet and rod fiber, miscellaneous interior fittings, miscellaneous interior fittings for switches, 85,000 3-amp glass-tube fuses, miscellaneous inclosed fuses (cartridge type), miscellaneous link and plug fuses, renewable fuses and elements for renewal, 3600 miscellaneous globes, insulators, electric soldering irons, mica and pressed mica plate, non-water-tight attachment plugs, etc., 20 portable ventilating sets, miscellaneous magnet wire. East, Schedule 6434—1975 portable non-water-tight guards, 31 120-volt electric flatirons. Philadelphia, Pa., and Mare Island, Cal., Schedule 6434—12 120-volt disk electric heaters. Puget Sound, Wash., Schedule 6434—120 keyless sockets, cat. 59954. Boston, Mass., and Norfolk, Va., Schedule 6434—45,000 two-hole wire terminals. Norfolk, Va., Schedule 6434—Miscellaneous terminal and stuffing tubes. Bids will also be received until April 28 for furnishing 20 testing motor-generating sets, to be delivered East and West as per Schedule 6570. Bids will also be received until May 5 for furnishing two turbo-generator sets to be delivered at Mare Island, Cal., as per Schedule 6564. Applications for proposals should designate the schedule desired by number. T. J. Cowie is paymaster-general U. S. N.

North Central

CADILLAC, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 27 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Cadillac, Mich. Drawings and specifications may be obtained from the above office or from the custodian of site at Cadillac. O. Wenderoth is supervising architect.

DETROIT, MICH.—The Council committee an public lighting has approved an appropriation of $10,842 for the installation of arc lamps on the Boston Boulevard. The lighting commission has asked for funds to erect 1000 new lamps this year.

MUNSING, MICH.—Within the next two months the El. Lt. & Pwr. Co., of Munsing, expects to erect 3 miles of transmission lines to furnish electricity to do the city pumping; also to purchase a 150-hp engine, one 200-kw, three-phase, 2300-volt generator, poles for two miles of transmission line, cross-arms, insulators, lightning arresters, etc., for a complete insulation. James Hosking is manager.

SAULT STE. MARIE, MICH.—Bids will be received by the Edison Sault El. Co., of Sault Ste. Marie, until April 15 for furnishing material and constructing an extension to its power house. Specifications and blueprints may be obtained upon application to the company for which a deposit of $10 will be required, to be refunded upon return of plans.

ASHTABULA, OHIO.—Plans are being prepared by business men on Bridge Street for the installation of ornamental street lamps similar to those erected on Main Street.

BARBERTON, OHIO.—Bids will be received at the office of O. D. Everhard, director of public service, Moore Block, Barberton, until April 4 for furnishing f.o.b. Barberton two 15-hp, three-phase, 60-cycle, 220-volt motors, automatic pressure regulator control to be included. Bids will also be received at the same time for two electrically driven deep-well pumps, directly connected.

CINCINNATI, OHIO.—T. C. Powell, vice-president of the Alabama Great Southern R. R. Co., has announced that the telephone will be substituted for the telegraph for dispatching trains and handling messages on the entire line between Chattanooga and Meridian, a distance of 296 miles.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, Room 513, City Hall, Cleveland, until April 1, for one hydraulic plunger freight elevator for the municipal electric-light plant. Specifications may be obtained at the office of the commissioner of the light and heat division, at 1443 East Third Street.

COLUMBUS, OHIO.—Bids will be received by B. L. Bargar, director of public safety, City Hall, Columbus, until April 1, for furnishing materials for the fire and police telegraph system of the city of Columbus as follows: For 375 B.T. chloride accumulator couples, 30 B.T. positive end plates, 30 B.T. negative end plates, 40 B.T. bolt connectors, 300 B.T. glass jars with grooved bottoms, electrolyte necessary for 300 cells for B.T. storage battery, 7000 lb. No. 10 D.T.B.W.P. copper wire, 1200 Hemingray long-distance glass insulators. Each bid must contain specifications of the wire proposed to be furnished with the name of the manufacturer of same. A sample of glass insulator must accompany each bid. J. R. Smith is secretary.

KENTON, OHIO.—The Hardin-Wyandotte Ltg. Co., which supplies electricity in Forest, Dunkirk and Upper Sandusky from its central station in Kenton, is planning to install a new 500-kw turbine with entire new condensing outfit. The company has recently installed new equipment and magnetite street lamps in the city of Kenton, and is also preparing to make further improvements and additions to its high-tension transmission lines. E. W. Lothrop is vice-president and general manager.

MANSFIELD, OHIO.—Bids will be received by the board of education until April 21 for furnishing material and erecting an eight-room addition to the Bowman School, including repairs to the old building; erecting a four-room addition to Newman School and also to the East Fourth Street School, including repairs to old buildings; repairs to Prospect Street, West Fourth Street and Marion Avenue school; work to include electrical fixtures and electric wiring, vacuum cleaner and heating apparatus. John H. Bristow is clerk.

NORWOOD, OHIO.—The Boss Washing Machine Co., of Norwood, it is reported, will soon open bids for material and equipment for a power plant for its factory. Plans are now being prepared for a new reinforced-concrete factory building by E. H. Dornette, Pickering Building, Cincinnati, Ohio.

SPRINGFIELD, OHIO.—A committee has been appointed by the Industrial Bureau of the city of Springfield to investigate the project of building a modern power building to meet the needs of small manufacturing plants to which power and light will be furnished.

DANVILLE, KY.—The new hotel which is to be built by Malcolm Weisiger, of Danville, will be equipped with electric elevators.

FRANKFORT, KY.—The Kentucky Pub. Ser. Co., it is reported, is contemplating utilizing energy generated at its Lexington plant to operate the local system, and proposes partly to dismantle the Frankfort plant. The Lexington plant, it is said, will require additional transmission equipment.

HARLAN, KY.—Plans are being prepared by the Harlan Coal Mining Co. for the erection of a large central electric power plant to supply electricity to its mines in Harlan County and adjacent fields.

LEXINGTON, KY.—The Kentucky Pub. Ser. Co., of Lexington, which has acquired and is operating a number of plants in Kentucky, has purchased a 20-year franchise to operate an electric light and power system in Christian County outside of incorporated towns, of which Hopkinsville is the largest. The franchise was purchased for the purpose of covering an extension of a transmission line from the company's plant in Hopkinsville to Pembroke to furnish electricity to the last-named town, and other extensions which may be made later.

LOUISVILLE, KY.—Improvements are contemplated to the Jefferson County Fiscal Court House in Louisville, including the installation of two additional elevators.

OAKDALE, KY.—Bids will be received by the city of Oakdale until May 1 for a franchise to furnish electricity for street and domestic lighting in Oakdale. For further information address J. A. Hagan, Mayor, 3830 Grand Boulevard, Louisville, Ky.

PADUCAH, KY.—The Illinois Central R. R. Co., it is reported, is planning to establish locomotive and steel car repair shops in this city, which will be equipped with electrically driven machinery. The main office of the company is in Chicago, Ill.

PADUCAH, KY. — Announcement has been made by the Kentucky Southwestern Interurban Ry. Co. that contract has been awarded for construction of its proposed electric railway from Henderson to Hickman, taking in many of the important towns in western Kentucky. The headquarters and main power station will be in Paducah.

WHITESBURG, KY.—The Letcher County El. Lt. & Pwr. Co., it is reported, will purchase a 500-kw, three-phase, 60-cycle, 2400-volt generating unit, with complete condensing outfit. For further information address Samuel Collins, of Whitesburg.

GOSHEN, IND.—The Hawks El. Co., of Goshen, has petitioned the Public Service Commission for permission to extend its transmission lines to Waterford and New Paris. The cost of the proposed extension is estimated at $4,000.

INDIANAPOLIS, IND.—It is reported that Robert S. Fletcher, of Indianapolis, is contemplating the construction of a hotel and coliseum, to cost about $1,000,000. The building will be 12 stories high and will have its own electric plant.

INDIANAPOLIS, IND. — Specifications for street-lighting prepared by the city engineer are in the Mayor's hands and will soon be presented to the Board of Public Works. The contract for street-lighting does not expire until next year, and preparing specifications at this time will give any new company that may be a successful bidder an opportunity to install equipment to furnish the service.

LAWRENCEBURG, IND.—The W. P. Squibb Distilling Co., of Lawrenceburg, has awarded a contract to the J. R. Stevens Co., of Cincinnati, Ohio, for the construction of a distillery and grain elevator, for which electric power and lighting equipment will be required.

NEW ALBANY, IND.—The Mill City Cotton Mills, which have been organized by J. E. Wiley, will be equipped for electrical operation. It is understood that a generating set capable of developing 200 hp will be purchased.

WEST BADEN, IND.—The West Baden Wtr., Lt., Ht. & Pwr. Co. has applied to the Public Service Commission for permission to purchase the property of the French Lick Lt. & Wtr. Co., of French Lick, which is owned by Thomas Taggart, and a water franchise and plant in West Baden, owned by Edward Ballard. The West Baden company proposes to consolidate all the public utilities in West Baden and French Lick and neighboring towns and resorts.

CHICAGO, ILL.—Plans are being prepared by Chatten & Hammond, architects, 64 East Van Buren Street, Chicago, for the erection of a new six-story building, 84 ft. by 150 ft., to be erected on St. Clair Street, for the Merchants' Syndicate Catalogue Co., at a cost of about $150,000. The proposed building will be equipped with two low-pressure boilers, two electric passenger elevators and two electric freight elevators. Bids for construction of the building will be received from April 1 to April 15.

CHICAGO, ILL.—Within the next ten months the city of Chicago expects to erect one power station and install three 250-kw, 12,000-volt transformers and 20 induction regulators (5000 volt, 10 amp); also to purchase lightning arresters, oil switches, ammeters (0-50 amp), 5000-volt voltmeters, No. 6 single-conductor, lead-covered cable; also eight-conductor cable (12,000 volts), 2000 arc lamps, 1000 tungsten lamps (4 amp, 20 volts) and 500 lamp-posts. M. Ferry, 614 City Hall, Chicago, is engineer in charge.

CISSNA PARK, ILL.—Within the next five months the El. Ser. Co., of Cissna Park, expects to erect new distribution lines and change its system to three-phase, 60 cycles. E. Lindnor is manager.

CLAYTON, ILL.—Within the next few months the Central Illinois Pub. Ser. Co., of Mattoon, expects to erect a substation in Clayton. As yet no definite arrangements have been made. J. Clarence Maguire is local superintendent.

EASTON, ILL.—The local electric-light-plant and machine shop, owned by E. W. Fuller, is reported to have been destroyed by fire recently.

LOCKPORT, ILL.—The Public Ser. Co. is reported to have offered the City Council $10,000 for the municipal electric-lighting system.

FALL RIVER, WIS.—The site where the Lashier Mill formerly stood, which was destroyed by fire recently, has been purchased by Julius Frederick, who, it is understood, will rebuild the mill. It is probable that a stock company will be formed to operate the lighting plant, which is to secure energy from the mill.

KENOSHA, WIS.—Bids will be received by George W. Harrington, city clerk, until April 6 for the installation of inverted magnetite-arc lamps and furnishing electricity for same. The arc lamps are to be erected on ornamental cast-iron standards.

ADRIAN, MINN.—The city of Adrian has recently purchased a 50-kw, 250-volt Triumph generator, one 72-in. by 18-ft. Brownell boiler and one 4-in. plunger pump belted to a 5-hp Triumph motor. This equipment will be installed by T. W. Newell, superintendent of light and water station.

FARMINGTON, MINN.—Within the next three months the Farmington El. Lt. & Pwr. Co. expects to erect 12 miles of 13,200-volt, three-phase, 60-cycle pole transmission lines and to install an underground steam-heating system; also to purchase a 50-kw to 75-kw, three-phase, 60-cycle, 2300-volt generator, with engines, boilers and necessary auxiliaries; also switchboard and transformers. F. H. Eddy is manager.

MINNEAPOLIS, MINN.—The recent decision of the Minnesota Supreme Court upholding the right of the University of Minnesota to build an electric railway from the main campus to the Agricultural College has cleared the way for the construction of the line, for which steps will be taken at once.

MOORHEAD, MINN.—Within the next three or four months the Water and Light Commissioners expect to purchase one 500-kw generator and turbine. R. G. Price is city clerk.

NEW PRAGUE, MINN.—Within the next two months the board of electric-light commissioners expects to install a 66-in. by 18-ft. high-pressure tubular boiler and to purchase one 6-in. non-returning boiler stop valve. Joseph T. Rynda is superintendent.

WAUBUN, MINN.—Chandonnet & Son, it it is reported, have been granted a franchise to install and operate an electric-light system in Waubun.

ODEBOLT, IA.—The Odebolt Gas Co., it is reported, contemplates the installation of an electric-lighting system.

WILLIAMS, IA.—The Williams El. Lt. & Pwr. Co. is reported to be contemplating erecting a transmission line to Blairsburg to furnish electricity for lamps and motors in that town. F. R. Payne, of Williams, is manager.

WINTERSET, IA.—Bids will be received by H. S. Ely, city clerk, Winterset, until April 6 for furnishing the following sup-

plies: 25 electric meters, 1000 electric lamps, 500 lb. insulated wire, 500 lb. copper wire, 100 cross-arms, 400 pins and 250 insulators.

HAMILTON, MO.—C. A. Martin and T. D. Parr, it is reported, are contemplating the installation of an electric-light plant in Hamilton.

KING CITY, MO.—The King City El. & Mfg. Co. expects to purchase within the next 30 days two double-throw or triple-throw pole oil switches, 2300-volt, hand-operated (second-hand preferred). The company expects to establish a day service May 1. Harry V. Forest is manager.

WILLOW SPRINGS, MO.—J. B. Quigley, who built the short-line railroad connecting Mansfield and Ava, is promoting a hydro-electric power plant on North Fork, a tributary of Current River. If sufficient capital is secured, he proposes to construct a plant to supply electricity in Willow Springs, Mountain View, Cabool and other towns in this part of the State.

RHAME, N. D.—A movement has been started to establish an electric-light plant in Rhame.

WILLOW CITY, N. D.—Application has been made to the Council by Robert Hunt for a franchise to construct and operate an electric-light plant in Willow City.

GARY, S. D.—The Citizens' El. Co. expects to purchase within the next two months one 50-hp compound engine and one 100-hp boiler. Hans Nordley is manager.

EDGAR, NEB.—The Edgar Commercial Club is reported to be interested in a project to secure development of the water-power on the Blue River near Edgar.

MADISON, NEB.—Within the next 30 days the managers of the municipal electric-light plant expect to purchase a 100-hp Corliss engine (probably Bates) to replace the present engine. The municipal plant will be rebuilt this spring. The cost of enlarging the power house is estimated at $3,000. A. E. Kernick, manager, will have charge of the work.

MINDEN, NEB.—The Almo Engine & Supply Co., of Omaha, is reported to have been awarded the contract for the construction of an electric power station at $12,571 and for two engines to the Merkle-Hines Machinery Co. The sub-contract for construction of power house has been awarded to Jens Kundsen, of Minden.

NORTH LOUP, NEB.—Bonds to the amount of $20,000, it is reported, have been voted for the installation of an electric-light plant and water-works system in North Loup.

OMAHA, NEB.—The Illinois Trac. Co. (McKinley system), owner of the Omaha & Lincoln Ry. & Lt. Co., has filed mortgages for $2,225,000 covering all the property in Nebraska, to secure an issue in bonds. The proceeds are to be used in extending its electric lines from Omaha to Lincoln. At present 17 miles of the road is in operation. The McKinley syndicate also furnishes electricity for lamps and motors in several Nebraska towns.

ORD, NEB.—The City Council contemplates calling an election to vote on the proposition to issue bonds for the construction of an electric-light plant, extension to water-works system and erection of a new city hall building. The plans provide for an expenditure of $5,000 for electric plant, $18,000 for water-works extensions and $7,000 for city hall.

OVERTON, NEB.—The town of Overton is contemplating the purchase of the local electric-light plant, owned by W. H. Hill, and will probably take over the system April 1.

TALMAGE, NEB.—The local electric-light plant is reported to have been purchased by William J. Ritter, who, it is said, contemplates making extensions and improvements to same.

UNIVERSITY PLACE, NEB.—Within the next six months the Water and Light Commission expects to erect several line extensions; also to purchase a pump, underground conduit, several transformers, lamp-posts and some household labor-saving devices. F. Harbican is water commissioner.

ATCHISON, KAN.—The Council has passed an ordinance authorizing the Mayor to enter into a contract with the Thayer Foundry Co. for the installation of an ornamental lighting system on Commercial Street between the east line and Fifth Avenue. For further information address C. C. Finney, Mayor.

GARDEN CITY, KAN.—Announcement is made by the officials of the United States Sugar & Land Co., of Garden City, that it will build an electric interurban railway to connect its numerous irrigated ranches in this section. The company is now installing a large electric power plant at Garden City, details of which were published in the issue of Feb. 21.

Southern States

BOONE, N. C.—Plans and specifications are being prepared for a 200-hp hydroelectric development on the New River for the Appalachian Training School, of Boone. A three-phase transmission line will supply electricity for lamps and motors for the school and the town of Boone. Bids will be asked for construction of plants as soon as specifications are completed. The cost of the plant is estimated at about $6,000. D. R. Shearer, of Knoxville, Tenn., is consulting engineer.

BURLINGTON, N. C.—The Piedmont Ry. & El. Co., of Burlington, has completed its new electric generating station. The present output of the plant is 3000 hp, which, it is understood, will be increased by 3000 hp, making a total of 6000 hp. The transmission lines of the company supply electricity in Graham, Haw River, Mebane and Burlington.

HIGH POINT, N. C.—A committee has been appointed by the Mayor to make investigations relative to the purchase of a new arc-lamp lighting-system, to cost about $25,000. F. N. Tate is Mayor.

ROCKY MOUNT, N. C.—The Board of Public Works is now installing a 500-kw General Electric turbine and additional switchboard panel in the municipal electric-light plant. A. S. Lyon is superintendent.

CHARLESTON, S. C.—The capital stock of the Charleston Consol. Ry., Gas & El. Co., which is operated by the Charleston Ry. & Ltg. Co., has been increased by $500,000.

BALL GROUND, GA.—The city of Ball Ground is contemplating the installation of an electric-light plant and water-works system. For further information address J. B. Roberts.

GRIFFIN, GA.—The Towaliga Pwr. Co., of Griffin, has recently purchased a 1600-kva, three-phase General Electric generator (waterwheel type) and one 1800-hp Leffel waterwheel, with auxiliary equipment. F. Mayes is superintendent.

PELHAM, GA.—At an election to be held April 15 the proposal to issue $4,000 in bonds for extensions to the municipal electric-light plant and water-works system will be submitted to the voters.

ROME, GA.—The Rome Ry. & Lt. Co. has filed a petition with the Secretary of State asking for permission to increase its capital stock from $500,000 to $1,000,000. S. S. Bush is vice-president and general manager.

SYCAMORE, GA.—The City Council has granted the J. B. McCrary Co., Third National Bank Building, Atlanta, a franchise to furnish electricity in Sycamore. Energy for operating the system will be supplied by the municipal electric plant in Ashburn.

DYERSBURG, TENN.—The city of Dyersburg is contemplating making extensions to the ornamental street-lighting system. S. R. Blakeman is superintendent.

MEMPHIS, TENN.—C. P. Cooper, general agent for the Southern Railway in Memphis, is reported to be interested in a movement to extend the ornamental street-lighting system on Madison Avenue from the Lyric Theatre east to the new viaduct to be built by the company. Ornamental standards carrying lamp clusters will be erected on the viaduct.

SHELBYVILLE, TENN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 4 for construction, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Shelbyville. For details see proposal columns. O. Wenderoth is supervising architect.

ARKADELPHIA, ARK.—The Arkansas Railroad Commission has granted a charter to H. C. Couch, State National Bank Building, Little Rock, president of the Arkansas Pwr. Co., to construct a hydroelectric power plant on the Caddo River, 5 miles north of Arkadelphia, to cost about $235,000. Under the provisions of the charter work must begin on the plant within two years and be completed within four years.

ALEXANDRIA, LA.—Plans are being considered for enlarging the power house of the municipal electric-light plant; also for the installation of additional machinery. J. C. Raxdale is superintendent.

ALEXANDRIA, LA.—A stock company, it is reported, is being organized in Alexandria by J. Marion Stukes, of San Antonia, Tex., and N. Jeffers, of Browndell, Tex., for the purpose of installing an electric power plant to be operated by the Stukes water motor, a new invention. It is proposed to build a plant on boats in the river to generate electricity by power furnished by the waterwheel that is submerged in the stream.

EUNICE, LA.—Bids will be received at the office of the Mayor until April 16 for building, foundations, machinery and pole lines for a municipal electric-light plant. Plans and specifications may be obtained from E. M. Kursheedt, consulting engineer, Whitney-Central Building, New Orleans, La., upon deposit of $5, which will be refunded upon return of same. ....

NEW IBERIA, LA.—Plans are being considered for extending the electric-lighting plant and the water-works system, for which $4,000 is available.

BROWNWOOD, TEX.—The Texas Pwr. & Lt. Co. is contemplating the installation of a new street-lighting system in Brownwood, to cost about $15,000.

BRYAN, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 30 for the construction, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Bryan, Tex. Drawings and specifications may be obtained from the custodian of site at Bryan or at the above office. O. Wenderoth is supervising architect.

CORPUS CHRISTI, TEX.—The controlling interest of the Corpus Christi Street & Interurban Ry. Co., consisting of new power plant and 8 miles of car lines, is reported to have been purchased by Newburger, Henderson & Loeb, of Philadelphia, Pa. The new owners, it is understood, will make further improvements. The same interests have an option on the property of the Corpus Christi Ice & El. Co.

FORT WORTH, TEX.—Arrangements have been completed by the Fort Worth Pwr. & Lt. Co. whereby it will furnish energy to the counties of Dallas, Denton, Wise, Jack, Palo, Pinto and Parker. It is proposed to furnish electricity to towns and farms from the local plant.

HOWARD, TEX.—The installation of an electric-light plant in Howard is under consideration. Alexander Brothers are reported interested.

Pacific States

CHELAN, WASH.—Plans are being considered by the City Councils of Chelan and Lakeside for the installation of an electric-light plant and water-works system, for which it is understood that bids will soon be called. Mayor Emerson of Chelan is chairman of the investigating committee.

GLACIER, WASH.—The Washington Anthracite Coal Co., which operates a coal mine, located in the Government Reserve, 4 miles south of Glacier, has applied to the United States Forestry Department, Portland, Ore., for a permit to erect a transmission line from the main line of the Puget Sound Trac., Lt. & Pwr. Co. to the mine. The company also contemplates the construction of an aerial electric tramway for handling products of the mine. Some electrical machinery, including motors, generators, etc., it is understood, will be installed when the line is completed.

MOUNT VERNON WASH.—The Pacific Northwest Trac. Co., of Mount Vernon, has applied to the County Commissioners of Skagit County for permission to extend its transmission lines over any and all roads of the county to furnish electricity for lamps and motors. This company, which is a subsidiary of the Stone & Webster Engineering Corpn., of Boston, Mass., contemplates making extensive additions and improvements to its system in this section during the coming summer.

SOUTH BEND, WASH.—Application has been made to the City Council by Frank McKean for a franchise to supply heat, power and water in South Bend.

TOLEDO, WASH.—The Washington-Oregon Corpn., it is reported, will begin work immediately on the construction of a new transmission line between Winlock and Toledo. The main office of the company is at 1311 Yeon Building, Portland, Ore. F. M. Housh is construction engineer.

NEWBERG, ORE.—The Portland Ry., Lt. & Pwr. Co., of Portland, has purchased the property of the Yamhill El. Co., which operates in Newberg, Charlton, Dayton, and other towns in Yamhill County. The system of the Yamhill company has been connected with the high-tension line of the Portland company.

PORTLAND, ORE.—The Northwestern El. Co., of Portland, has submitted a bid for furnishing electricity for lighting the five bridges and the county hospital at 2 cents per kw-hr. The Portland Ry., Lt. & Pwr. Co. is now furnishing the service.

PORTLAND, ORE.—C. B. Hegart, chief engineer of the port of Portland, has been authorized to advertise for bids for furnishing five electrically operated winches, to cost about $2,100 each, a rotary converter, to

cost about $2,500, and equipment for power circuit and other equipment necessary in handling cargoes. The Portland Ry., Lt. & Pwr. Co. has been awarded the contract by the port of Portland to furnish electricity to Public Dock No. 1 at 2½ cents per kw-hr., for a period of three years.

SANDY, ORE.—The Portland Ry., Lt. & Pwr. Co. is contemplating extending its electric transmission line from Bull Run to Sandy, at a cost of about $5,000.

BAKERSFIELD, CAL.—The Board of Supervisors, it is reported, has decided to use electricity to operate the county's rock-crushing plant to be established at Keene. A transmission line will be erected by the county from the power plant at Big Creek, the cost of which is estimated at about $22,000. The work will be done under the supervision of the county highway commission, of which C. E. Getchell is chairman. P. H. Everett is engineer.

CHINO, CAL.—At a meeting of the alfalfa growers of this section held recently it was decided to accept the offer of the Edison El. Co. for electrical service and an agreement for one year is to be signed at once.

GLENDORA, CAL.—The Pacific Lt. & Pwr. Corpn. has been granted a franchise to construct and operate transmission lines for the distribution of electricity for lamps, heaters and motors for a period of 40 years in Glendora.

HUNTINGTON BEACH, CAL. — The Huntington Beach Lt .& Pwr. Co. has applied to the State Railroad Commission for permission to sell its distributing system to the Pacific Lt. & Pwr. Corpn., of Los Angeles, for $21,691. The Pacific company has completed its transmission line into this city and has also been granted a franchise by the board of trustees to furnish electricity for lamps and motors here. It is understood that the Pacific company will improve and extend the system in the near future.

LOS ANGELES, CAL.—Preparations are being made by the Home Telephone & Telegraph Co. for extending its service in the southeastern part of the city, which will involve an expenditure of more than $50,000 for equipment. The company is also making preparations to extend its service between southeast Los Angeles and Long Beach.

LOS ANGELES, CAL.—Bids will be received by the Board of Supervisors of the county of Los Angeles, Los Angeles, until April 6 for the construction of a girls' hospital at the Juvenile Detention Home. Steam heating and electric wiring will not be included in the above contract. H. J. LeLande is county clerk and ex-officio clerk of board.

LOS ANGELES, CAL.—The City Council will soon submit at a special election a proposition to issue $6,500,000 in bonds for power development purposes. The State Railroad Commission will be asked to condemn the private electrical distributing system or such parts as may be necessary for the distribution of power by the city. Of the proceeds of the bond issue, if carried, $1,250,000 is to be used for construction of a generating station and transmission lines and $5,250,000 in the condemnation and acquisition of the private distribution system. The city does not propose to build a new distribution system. In case the bond issue carries, it is understood that the city will seek to condemn the distribution system of the Southern California Edison Co. within the city limits.

NEWPORT BEACH, CAL.—Plans are being prepared for the installation of an ornamental street-lighting system in Newport Beach, consisting of 149 concrete or bronze standards and fixtures and underground conduits.

NEWPORT BEACH, CAL.—The Pacific Lt. & Pwr. Corpn., of Los Angeles, is reported to be negotiating for the property of the Newport Beach El. Lt. & Pwr. Co. The Pacific company has already erected a distributing system and is furnishing electricity here. C. H. L. Ghriest is owner of the local system.

PASADENA, CAL.—An ordinance has been passed by the city commissioners providing for the installation of ornamental street lamps on Madaline Drive and Colorado Street.

REDONDO BEACH, CAL.—The Pacific Lt. & Pwr. Corpn. has been granted a permit to erect a building in the Ocean Beach subdivision which will be used as an addition to power plant. The building will be 21 ft. by 53 ft. and will cost about $3,300.

SAN FRANCISCO, CAL.—The Pacific Gas & El. Co., of San Francisco, it is reported, will soon authorize an issue of $12,000,000 in capital stock, the proceeds to be used for improvements and additions to property.

VICTORVILLE, CAL.—An agreement has been reached between the residents of Victorville and the Southern Sierras Pwr. Co., of San Bernardino, whereby the latter will furnish electricity for lamps and motors here. It is understood that a substation will be erected and a distributing system installed.

BOISE, IDAHO.—The sale of the property of the Idaho-Oregon Lt. & Pwr. Co., of Boise, which was to have been made March 16, under the order of the court in receivership proceedings, has been deferred, and no date fixed for future sale. The property will continue to be operated by a receiver, and the court will be asked to authorize the issue of receiver's certificates for approximately $250,000, the proceeds of which will be used to install equipment to increase the output of the Ox Bow hydroelectric plant by 4000 hp.

TUCSON, ARIZ.—The Tucson Gas, Lt. & Pwr. Co. is reported to be contemplating making improvements to its plant, extending its street-car line to outlying districts and erecting transmission lines to furnish electrical service through the Rillito and Santa Cruz valleys. The cost of the work is estimated at about $200,000.

HELENA, MONT.—The property owners of the east side are contemplating establishing an east side lighting district, plans for which are being prepared by William Jordan, Jr., city engineer. It is estimated that at least 220 posts will be required.

ROUNDUP, MONT.—Within the next six months the Roundup Coal Mining Co. hopes to erect a new power house and a 250-volt transmission line; also to purchase two or three 72-in. by 18-ft. tubular boilers, one 200-kw, 250-volt generator with turbine, boiler feed pump and possibly a condenser, some rubber-covered transmission cable and weather-proof wire. J. E. Woodward is president and E. L. Rousseau purchasing agent.

RYEGATE, MONT.—A movement has been started by residents of Ryegate to establish an electric-light plant here.

WILSALL, MONT.—C. S. Hefferlin is reported to have been granted a franchise to establish an electric-light plant in Wilsall.

SPARKS, NEV.—Work has begun on the construction of an electric plant at the Sparks shops of the Southern Pacific R. R. Co., which when completed will furnish electricity to operate the block signal system of the Salt Lake division from Imlay to Blue Canyon. The building will be 60 ft. by 40 ft. and will cost about $40,000. Power houses are being erected at two other points along the division.

Canada

EDMONTON, ALTA.—Representatives of the firm of Smith, Kerry & Chase, of Toronto, Ont., are investigating the water-power in Athabasca at Grand Rapids with a view of building a hydroelectric power plant, to cost from $5,000,000 to $10,000,000. J. S. Kerry, a member of the firm, states that it will be possible to transmit energy generated at the plant to Edmonton, a distance of 175 miles. He expects to submit a proposition to the Department of Public Works to furnish energy at the city limits, to be distributed by the municipal system.

FERNIE, B. C.—Within the next two months the city of Fernie expects to erect 3 miles of service lines, material for which has already been purchased, also to purchase within the next six weeks material for a complete tungsten street-lighting system, covering a circuit of 9 miles, consisting of 100 lamps of 100 cp, 100 street brackets with reflectors, 500 locust pins (1½ in. by 9 in.), 500 glass insulators, 100 strain insulators, 47,000 ft. No. 6 weather-proof wire, one 10-kw or 12-kw tungsten regulator; switchboard with instruments and switches for control of this system. Tenders for this complete equipment will be received by the city of Fernie until May 7. James E. Finn is superintendent of light and power.

PRINCE RUPERT, B. C.—Within the next eight months the municipal electric light department expects to erect a power house with an output of 1800 hp and to erect 6 miles of transmission lines; also to purchase waterwheel, generator and exciter, switching equipment, 60 kw in transformers, poles for 10 miles of line, insulators and wire for same, and one 50-lamp rectifier outfit complete with lamps. T. C. Duncan is manager.

BATHURST, N. B.—The Bathurst Pulp & Paper Co., recently incorporated with a capital stock of $3,000,000, contemplates the construction of a large pulp and paper mill within the next year. The plans provide for the development of an extensive water-power on the Nepsisiquit River and the transmission of electricity to the plant at Bathurst.

MONCTON, N. B.—Plans are being prepared for the installation of a new street-lighting system in Moncton.

BLENHEIM, ONT.—The Town Council has passed a resolution requesting the Hydro-Electric Power Commission to submit an estimate as soon as possible of the cost of delivering energy to the municipality.

CORNWALL, ONT.—The Minister of Railways of the Canadian government has approved of the route for the proposed transmission line of the Cedar Rapids Mfg. & Pwr. Co., from Cedar Rapids to the transformer station in Cornwall, a distance of 44 miles. The company is building a large hydroelectric power plant at Coteau Landing, about 30 miles from Montreal.

ENGLEHART, ONT.—The installation of a street-lighting system in Englehart is reported to be under consideration.

KINCARDINE, ONT.—The installation of underground conduits for the new street-lighting system is under consideration. It is understood that the posts are to be of augmented cement or cast iron. For further information address Andrew Ingram, Kincardine.

OTTAWA, ONT.—Bids will be received by the chairman of the Municipal Electric Department, City Hall, Ottawa, until March 30, for electric meters, transformers, copper wire and sundry supplies. Specifications may be seen or obtained at the office of the Municipal Electric Department, 75 Laurier Avenue West. J. E. Brown is general manager.

ST. MARY'S, ONT.—The Hydro-Electric Power Commission has recommended that the arc lamps now in use be replaced by tungsten lamps at a cost of about $10,000.

WINDSOR, ONT.—A company has been organized by Harry Lee, C. H. Dollins, of Detroit, Mich.; B. Y. Fox, J. A. Straith, of Windsor, and Orville E. Reeves, of Toledo, Ohio, to erect a large power building, to be located at the corner of Carron and West Sandwich Streets, at a cost of about $80,000. The building will be rented out to a number of concerns for light manufacturing purposes.

MONTREAL WEST, QUE.—The Town Council is considering the installation of a street-lighting system.

MONTREAL, QUE.—Provision is made in this year's expenditure on the Montreal Harbor for equipping the railway system for electrical operation; the cost is estimated at $282,674, with $300,000 for equipment. The ultimate terminus of the railway system is Bout de l'Ile, which it is expected will be reached next year. On the south shore, where extensive improvements will be made, 8 miles of electric railway will be built.

OUTREMONT, QUE.—Tenders will be received by E. T. Sampson, secretary and treasurer, Town Hall, Outremont, until April 1, for furnishing 450 street-lighting standards, with globes, reflectors, insulators, sockets and accessories complete. Specifications and drawing can be obtained from the office of the town engineer, Town Hall.

WESTMOUNT, QUE.—The City Council has passed a by-law appropriating $250,000 for improving the municipal electric-lighting system and for placing all wires in underground conduits. The amount appropriated will provide for lamps on all residential streets and placing all wires underground.

CARLYLE, SASK.—Extensions and improvements involving an expenditure of $30,000, it is reported, are contemplated to the electric-lighting system. For further information address E. Holmes.

New Incorporations

SUGAR CREEK, OHIO.—The Sugar Creek Lt. & Pwr. Co. has been chartered with a capital stock of $25,000 to furnish light, heat and power. The incorporators are C. C. Sauser, W. H. Schweitzer, V. B. Halue, A. M. Mast and A. H. Hyler.

McALLEN, TEX.—The McAllen Ice, Lt. & Wtr. Co. has been granted a charter with a capital stock of $10,000. The incorporators are F. E. Osborne, R. E. Horn and J. T. Cardwell.

BLAINE, WASH.—The Blaine-Lynden El. Ry. Co. has been incorporated with a capital stock of $250,000 by John Pinckney, Lester Livingston and J. A. Willison.

POUND, WIS.—The Coleman-Pound Lt. & Pwr. Co. has been organized with a capital stock of $10,000 by the business men of Coleman and Pound to furnish electrical service in both towns. The company proposes to secure electricity from the High Falls plant of the Wisconsin Pub. Ser. Co.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 17, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,090,159. BRUSH HOLDER; J. C. Lincoln, Cleveland, Ohio. App. filed July 19, 1911. Screw in engagement with worm places brush spring under requisite tension.

1,090,188. RAILWAY SWITCH OR THE LIKE; W. A. Austin, Omaha, Neb. App. filed Jan. 31, 1910. Electric motor operated.

1,090,190. ELECTRICALLY CONNECTING DEVICE; R. J. Bell, Harvey, Ill. App. filed July 19, 1913. For clamping electric conductor to the base flange of a railway rail.

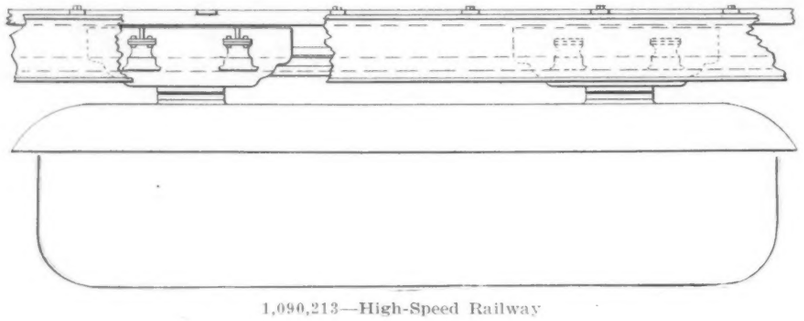
1,090,201. CHARGING SWITCH FOR STORAGE BATTERIES; C. W. Coleman (deceased), Westfield, N. J. App. filed Jan. 18, 1911. Particularly designed for the duplicate battery sets used in railway signaling service.

1,090,213. HIGH-SPEED RAILWAY; T. L. Johnson (deceased), Cleveland, Ohio. App. filed April 6, 1906. A magnetic field sustains and propels the car.

1,090,215. MECHANISM FOR ELECTRICALLY CONTROLLING AND OPERATING FARE REGISTERS; E. J. Kennedy, New York, N. Y. App. filed April 10, 1913. Electrically operated fare register, push-button control.

1,090,234. INSULATING AND SUPPORTING MECHANISM; J. W. Rogers, Woodbury, N. J. App. filed May 12, 1913. The insulating support for the third-rail fits over the base of the support for the protecting board.

1,090,238. ELECTRIC CURLER AND THE LIKE; E. Schwartz, Chicago, Ill. App. filed April 1, 1913. Has rotatable plug terminals to prevent twisting of the cord.



1,090,213—High-Speed Railway

1,090,301. CONTROL OF SIGNAL LAMPS; L. A. Hawkins, Schenectady, N. Y. App. filed Nov. 20, 1911. Controls the signal lamp from a central point by the alternating-current transmission system.

1,090,302. VEHICLE SIGNAL; J. B. Hawks and H. R. Kennedy, Los Angeles, Cal. App. filed July 17, 1912. Semaphore-type auto rear signal.

1,090,309. ELECTRIC RAILWAY SIGNAL; J. B. Howell, Leavenworth, Kan. App. filed Aug. 30, 1910. For switches operated by the trolley of a car at a turn-out or station.

1,090,328. SINGLE-PHASE MOTOR; C. B. Mills, East McKeesport, Pa. App. filed May 27, 1912. Starting characteristics of series motor and operating characteristics of squirrel-cage induction motor.

,090,339. ELECTRICALLY HEATED STOVE; T. S. Perkins and E. E. Rose, Pittsburgh, Pa., and Swissvale, Pa. App. filed July 24, 1911. Unitary structure with switching device permanently mounted beneath it and operated from the side of the stove.

1,090,354. SOCKET FOR INCANDESCENT ELECTRIC LAMPS; W. C. Tregoning, Cleveland, Ohio. App. filed May 13, 1912. Regular socket with special spindle frame and sheet-metal cam.

1,090,357. ELECTRIC SIGNAL SYSTEM FOR RAILWAYS; H. J. Warthen, Washington, D. C. App. filed June 16, 1910. Devices operate by gravity when circuits are broken to apply the air-brakes.

1,090,362. ELECTRIC SIGNAL FOR RAILWAYS; H. J. Warthen, Washington, D. C. App. filed March 24, 1909. Rails-in-circuit system.

1,090,363. TROLLEY FOR ELECTRIC SIGNALS FOR RAILWAYS; W. H. Warthen, Washington, D. C. App. filed June 16, 1910. For making contact with short ramp rails.

1,090,372. DRY BATTERY; J. A. E. Achenbach, Hamburg, Germany. App. filed Jan. 7, 1913. Negative electrode consists of layers of corrugated, finely perforated zinc.

1,090,378. RAILWAY SIGNAL-OPERATING MECHANISM; J. Blackburn, Kirkwood, Mo. App. filed May 15, 1911. Mechanically operated and electrically controlled.

1,090,391. APPARATUS FOR MANUFACTURING NITROGEN COMPOUNDS; T. Fujiyama, Tokyo, Japan. App. filed April 12, 1913. Supplies carbide to a roller in a heated nitrogen chamber.

1,090,394. COIL-INSULATING MACHINE; E. Haefely, Basel, Switzerland. App. filed April 20, 1911. Wraps insulating material with pressure.

1,090,419. CALIBRATING DEVICE; S. D. Sprong, Brooklyn, N. Y. App. filed Feb. 10, 1913. Provides a second and fixed coil which incloses the movable coil and is disposed at an angle thereto.

1,090,427. ELECTRIC ZINC FURNACE WITH INTEGRAL CONDENSER; J. Thomson, New York, N. Y. App. filed Jan. 2, 1913. Grate supports a bed-of-carbon resistor.

1,090,428. ELECTRIC ZINC FURNACE WITH INTEGRAL CONDENSER; J. Thomson, New York, N. Y. App. filed April 14, 1913. Has compound parallel porous resistors.

1,090,429. UNIVERSAL ELECTRIC FURNACE COMBINED WITH MEANS FOR CONDENSING ZINC; J. Thomson, New York, N. Y. App. filed June 7, 1913. Resistor of trapezoidal form and an underlying sump.

1,090,435. HARMONIC SIGNALING SYSTEM; H. G. Webster, Chicago, Ill. App. filed March 11, 1912. Employs alternating currents of different frequencies and selectively operated reed bells.

1,090,436. CALL BELL; H. G. Webster, Chicago, Ill. App. filed March 11, 1912. Applies magnetic stresses corresponding in direction and frequency to the impressed current impulses to a tuned reed striker.

1,090,445. CARTRIDGE FUSE; L. D. Blackman, Battle Creek, Mich. App. filed March 29, 1913. Has screw-threaded-ferrule end members which clamp the fuse strip.

1,090,455. RAILWAY SIGNALING APPARATUS; W. J. Cook, Denver, Col. App. filed March 4, 1911. Green light in cab changes to red when approaching a track signal.

1,090,456. PROCESS OF FORMING JOINTS; W. A. Darrah, Brooklyn, N. Y. App. filed July 22, 1911. Electrolytically produced joint between a conductor and glass or porcelain.

1,090,489. METER-TESTING CUT-OUT; T. E. Murray, New York, N. Y. App. filed Feb. 7, 1912. Two series of circuit terminals on opposite sides of the cut-out block may be connected interchangeably to the load and service leads.

1,090,527. CAP AND SHELL FASTENING FOR LAMP-SOCKET CASINGS; E. H. Freeman, Trenton, N. J. App. filed April 11, 1912. Admitting of practically universal circular adjustment.

1,090,528. ELECTRICAL BORDER-LIGHT RECEPTACLE; E. H. Freeman, Trenton, N. J. App. filed Aug. 22, 1913. Wiring extends in substantially continuous shape throughout the wiring conduit contained in the trough.

1,090,551. MANUFACTURE OF SUPERHEATER UNITS; C. K. Lassiter, Richmond, Va. App. filed June 5, 1913. Forms return bend body and return bend cap in separate forged sections and electrically welds them together.

1,090,557. TRANSMITTER; R. S. M. Mitchell, Syracuse, N. Y. App. filed May 10, 1913. Vibrating diaphragm for three-way transmitter.

1,090,568. MEANS FOR COLLECTIVELY ACTUATING AND CONTROLLING ALTERNATING-CURRENT MOTORS; J. L. Routin, Paris, France. App. filed Dec. 16, 1912. For controlling gun mechanism on warships.

1,090,579. ELECTRIC HAIR DRIER; J. T. Stapleton, Jersey City, N. J. App. filed June 28, 1913. Made in the style of a comb.

1,090,618. PROCESS AND MACHINE FOR MAKING SWITCH PARTS; W. F. Hosford, Chicago, Ill. App. filed Oct. 12, 1912. For welding platinum-disk contacts to springs.

1,090,619. PROCESS AND MACHINE FOR FORMING AND AFFIXING SWITCH CONTACTS; W. F. Hosford, Chicago, Ill. App. filed Oct. 12, 1912. End of platinum wire pressed against surface of the work is welded thereto by passage of electric current and wire is then cut.

1,090,624. CASING FOR ELECTRIC CELLS; I. Kaempfer, New York, N. Y. App. filed Dec. 18, 1912. Sealed paper carton with flush terminals for testing.

1,090,627. SIGNALING DEVICE FOR PARTY-LINE TELEPHONES; T. Kernan, East St. Cloud, Minn. App. filed Aug. 8, 1912. Name of eavesdropping party is made known to the parties talking.

1,090,629. ELECTRIC SOCKET; G. C. Knauff, Chicago, Ill. App. filed April 7, 1913. For axially disposed endward contacts such as used in auto head and tail lamps.

1,090,630. SOCKET FOR ELECTRIC LAMPS; G. C. Knauff, Chicago, Ill. App. filed May 26, 1913. Has spring-contact fingers engaging lamp base and holding it in place.

1,090,657. TROLLEY; H. Shaffert, East Pittsburgh, Pa. App. filed Feb. 19, 1913. Retaining members pulled apart by cords.

1,090,669. INDICATING DEVICE FOR DRAINS AND THE LIKE; J. H. Woodington and E. H. Coles, Clevedon, England. App. filed Nov. 7, 1913. Indicates whether intercepting traps in a drainage system are free.

1,090,672. ELECTRIC CURLING-IRON HEATER; C. H. Austin, Palmyra, N. Y. App. filed Oct. 21, 1912. Screws into socket like ordinary lamp.

1,090,682. ELECTRIC SHOE; K. H. Brown, Chicago, Ill. App. filed March 26, 1909. Has foot-engaging electrodes and a cell in the heel of the shoe.

1,090,686. INSULATOR CLAMP; W. A. Cook, Shinnston, W. Va. App. filed April 9, 1913. Adjustable and releasable clamp locks conductor to insulator.

1,090,726. CARBON HOLDER FOR ELECTRIC-ARC LAMPS; B. B. Lacy, Houston, Tex. App. filed July 24, 1911. Positive acting carbon clutch.

1,090,749. RECORDING MECHANISM; H. W. Payne, Rochester, N. Y. App. filed April 24, 1913. The action with respect to the galvanometer is practically frictionless.

1,090,763. ELECTRIC-BATTERY CELL; H. A. Thomas, Springfield, Ill. App. filed May 17, 1912. Two-fluid type.

1,090,794. AUTOMATIC CIRCUIT-CLOSING DEVICE FOR ELEVATORS; C. W. Sauer, Jr., Elizabeth, N. J. App. filed Sept. 16, 1912. Door switch.

1,090,805. JUNCTION BOX; J. F. Wagner, South Bend, Ind. App. filed Aug. 28, 1911. Obviates necessity for placing cross-bars between joists for the support of the box.

1,090,806. AUTOMATIC AIR-BRAKE CONTROL FOR RAILWAYS; H. J. Warthen, Washington, D. C. App. filed June 16, 1910. Applies brakes when electric signal circuit is broken.

1,090,816. SIGNALING DEVICE; C. Henschel, New York. App. filed April 18, 1910. For transmitting signals to those operating the ships or the guns on shipboard.

1,090,821. TELEPHONE SYSTEM; F. R. Parkerm, Chicago, Ill. App. filed June 20, 1904. Prevents operator from "listening in."

1,090,825. RAILWAY SIGNALING SYSTEM; M. H. Collins, West Hoboken, N. J. App. filed March 5, 1913. Dispenses with insulated joints, reactance bonds, impedance coils, etc.